Apple Service Toolkit
Reference Guide

Version 1.3.2

February 27, 2012

Document Notes

This document supports Apple Service Toolkit 1.3.2 and its components:

Component	Version	Component	Version
AST	1.3.2	Gateway	1.3
AST disc image	_ssps_004-0531.dmg	Gateway Mgr	1.0.8
Audio Test	1.0r3	Menu	1.3
CSD	1.3.4r1 / 1.4.2r1	MRI	1.0.23r1 / 1.0.24r1
Diagnostic OS disc image for Snow Leopard 10.6 w/ CSD	AST_OS_3_Install.001.dmg AST_OS_3_Install.002.dmg AST_OS_3_Install.003.dmg	NAD	1.1.11r2
		OS volumes and versions	AST_OS_3: CoolSystem 10.6.7 (10J4139) AST_OS_4: CoolSystem 10.7.1 (11B2117) AST_OS_5: VSTOS 10.7.2 (11C74)
Diagnostic OS disc image for Lion 10.7 w/ CSD	AST_OS_4_Install.001.dmg AST_OS_4_Install.002.dmg AST_OS_4_Install.003.dmg	SBS	1.0.3r3
		Service	217
Diagnostic OS disc image for Lion 10.7 w/ VST	AST_OS_5_Install.001.dmg AST_OS_5_Install.002.dmg AST_OS_5_Install.003.dmg	TPT	1.0.4r1
		VST	1.0.1r3

Notes About Images In This Guide

Screenshots and other graphics are for illustration purposes only and may not show current or observed menus, dialog boxes, verbiage, values or versions; however, steps and procedures remain the same unless noted. Graphics have not been localized and remain in U.S. English.

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Document Updates

NEW!

February 2012—What's New

- Identifies non-Apple memory — MRI notifies you if the unit under test (UUT) has non-Apple memory installed. NOTE: Third-party memory will not be replaced as part of a warranty repair, nor can third-party memory be sent to Apple as part of a repair.
- Audio input/output testing — A new Audio Test checks each speaker separately and determines whether a tone created by the computer is detected by the built-in microphone.
- NVRAM and SMC reset button — MRI now has a button that quickly resets the NVRAM and SMC on a UUT, saving time during troubleshooting.
- Most recent Time Machine backup — Under Software Specifications, MRI shows you when Time Machine was last used to back up the computer.

December 2011

- Improved performance, plus compatibility with MacBook Pro (Late 2011) computers.
- Video System Test (VST) diagnoses intermittent display issues in MacBook Pro (15-inch, Mid 2010) models when the computer has passed all Mac Resource Inspector (MRI) checks.
- Gateway Manager checks its components and versions, and if needed, displays a warning message that an updated version is available for download from Apple.
- Gateway Manager displays a verification op code in the result log list for each test run, verifying that Apple received each result log.
- On Mac portables, MRI flashes the keyboard backlight on and off to verify its functionality.

September 2011

- AST supports MacBook Air (Mid 2011) and Mac mini (Mid 2011) computers, including an updated OS X 10.7-based Cooling System Diagnostic for MacBook Air (Mid 2011) models.
- Instructions for installing OS X Lion Server have been added.
- AST Component Compatibility Chart provides an at-a-glance overview of all AST tests.

August 2011

- **Important**: AST must be run on a 64-bit-capable Mac with OS X Server 10.6 or later installed. AST will not work on 32-bit-only Macs or on OS X Server versions earlier than 10.6.
- MRI notifies you when the Mac OS version installed on a user's computer is incorrect.
- A standard Cooling System Diagnostic test for iMac (Mid 2011) and an extended Cooling System Diagnostic test for MacBook Pro (Early 2011) troubleshoots intermittent thermal issues.
- MRI reports defective LEDs in the display backlight of MacBook Pro (Early 2011) computers.
- AST provides support for MRI and SBS for Mac mini and Mac mini Server (Mid 2011) models.

June 2011

- Server Bit Setter Utility added to the main AST menu.

May 2011

- AST incorporates a new Cooling System Diagnostic.
- MRI provides a graphic representation of battery status in the battery icon.
- MRI provides a call-out of empty memory slots.
- Diagnostic Gateway shows whether your AST installation is up to date.

March 2011

- AST supports all Intel-based Macs including MacBook Pro (Early 2011).
- Notebook and Battery Adapter Diagnostic (NBAD) is renamed Notebook Adapter Diagnostic (NAD) and only checks power adapters. MRI is now the primary tool for checking batteries.
- Test Patterns Tool (TPT) helps identify pixel anomalies in LCD panels with LED backlighting in Apple Display, iMac, MacBook, MacBook Pro, and MacBook Air systems.

December 2010

- Both AST Diagnostic Gateway and Gateway Manager show whether your network is connected to the Apple Diagnostic Repository (ADR), ensuring AST results are correctly reported to Apple.
- Other NetBoot images on your AST server will be visible in the Diagnostic Gateway. AST supports MacBook Air (Mid 2010), Mac Pro (Mid 2010) and Mac Pro Server (Mid 2010).
- MRI logic board check shows the audio volume setting ('muted,' 'low,' or 'active'), helping you troubleshoot sound issues when sound is simply set too low to be heard.

October 2010

- AST supports other NetBoot images served from the same DG, allowing you to boot from other NetBoot images on your server.
- If you have AST and Gateway Manager running on a Mac Pro or Xserve, you can choose which Ethernet port units under test (UUTs) boot to. Advanced networking options are now integrated into Gateway Manager.
- The camera check in this version now supports more Mac models.

September 2010

- New AST network configuration isolates the UUT LAN from the Internet.
- Updated NetBoot and DHCP instructions address network configurations that use multiple wired Ethernet ports. NetBoot and DHCP should be enabled on the UUT LAN only.
- New section on using the NAD within AST.
- New instructions and screenshots to describe the new naming convention for NAD log files. In the latest versions of AST, battery and power adapter log files are unified under a single filename (NBD) instead of being listed as separate filenames (NBD and PAD).

June 2010

- Original release

Contents

3 Document Updates

7 Glossary

8 System Overview
  AST Component Compatibility Chart

11 Expectations For Use: Workflow
  AST Support

12 AST Diagnostic Gateway Network Requirements
  Scenario 1: No other NetBoot servers on LAN subnet
  Scenario 2: One existing Apple NetBoot server on subnet
  Scenario 3: Isolated UUT (Unit Under Test) network required

19 How to Configure a Mac for DG Use

20 Installing OS X Server v10.6 Snow Leopard on the DG Mac

24 Installing OS X Lion Server 10.7 on the DG Mac
  Using Server Admin

29 NetBoot Server Configuration

34 Gateway Manager Configuration
  Apple ID Validation

42 Gateway Manager Logs Details

43 Using Multiple AST Servers with AST
  Gateway Controller Behavior
  Managing a Multiple-Server Diagnostic Gateway

44 Updating AST Software

45 DHCP Server Configuration

46 Using AST

49 Using MRI
  UUT Hardware Specifications
  UUT Software Specifications

56 Using Notebook Adapter Diagnostic (NAD)

59 Using Test Patterns Tool (TPT)

62 Cooling System Diagnostic (Standard and Extended)

67 Server Bit Setter

68 Video System Test (VST)

Using MRI and VST
70 Using Audio Test
71 UUT Information Sent to Apple
72 Interpreting MRI Results
74 Interpreting AST Results with No Video
76 UUT Sleep Indicator Light Behavior
77 AST Keyboard Operation
78 Using Gateway Manager to Access UUT Logs
Op Codes
82 Detailed Description of All MRI Checks
83 Logic Board (MLB)
84 SD Board
86 Bluetooth
87 AirPort
88 Display
89 Camera
90 Apple USB Input Devices
91 Optical Drives
93 Ethernet
94 Battery (Portable Macs Only)
96 Power Adapter (Portable Macs Only)
98 Hard Drive
100 Power Supply (Desktop Macs Only)
101 Fan (motors)
103 GPU (Video Controller)
104 Sensors
107 Processors
108 Memory
Using MRI to Identify Non-Apple Memory
112 Limitations

Glossary

ADR Apple Diagnostic Repository is the server at Apple that receives logs from local AST servers.

ASD Apple Service Diagnostic

AST Apple Service Toolkit: The entire diagnostic system, comprised of the Diagnostic Gateway and its constituent diagnostics, including CSD, MRI, NAD, SBS, TPT and VST.

Check MRI uses the word "check" when it probes for the existence of a module, component, or subsystem. When MRI "checks" for the optical drive, for instance, it detects the presence of the optical drive hardware, but it does not examine the actual hardware functionality itself. Quickly knowing which hardware is not being detected can be immensely beneficial during initial triage.

CSD Cooling System Diagnostic **e**valuates thermal sensors, fans and heat sinks in newer Intel Macs. CSD is useful for assisting customers with questions about fan noise.

DG Diagnostic Gateway: Software that runs on dedicated Intel-based Macs with OS X Server 10.6 or later. The DG hosts and delivers bootable diagnostic images to units under test (UUTs) simultaneously over a network using NetBoot. The DG also gathers and stores log information from UUTs. The DG can be either a single AST server, or multiple AST servers on the same LAN.

MRI Mac Resource Inspector: EFI-based diagnostic software served up by the DG to UUTs over NetBoot. MRI gathers information and checks components in the UUT's configuration, reports log results back to the DG over a network, and displays results on the UUT's display.

NAD Notebook Adapter Diagnostic: EFI-based diagnostic software served up by the DG to UUTs via NetBoot. NAD reports the condition of Intel-based notebook batteries and power adapters.

NetBoot NetBoot is a network technology supported in OS X Server that serves up disk images to client Macs over a network. A Mac running NetBoot services, such as the DG, is known as a NetBoot Server. Macs have long supported the ability to start up "disklessly"—entirely from a network-based disk image—without needing to access the computer's hard drive. Holding down the N key during startup is a shortcut to attempt to NetBoot a Mac from a NetBoot server.

SBS Server Bit Setter makes sure computers such as Mac mini (Mac OS X Server), Mac mini Server (Mid 2010) or Mac Pro (Mid 2010) with OS X Server continue to be identified as servers after a logic board or backplane board replacement.

Test MRI uses the word "test" when verifying functionality of a hardware component. For example, MRI performs functional tests of the RAM, logic board, processor, battery, sensors, and fans, whereas it only checks for the presence of an SD board, Bluetooth and AirPort cards, display, USB input device, hard drive, optical drive, Ethernet port, and power adapter. Using NetBoot, the client system (UUT) runs independently of its hard drive, making it possible to quickly diagnose issues—even issues that prevent the UUT from booting to its internal hard drive—without needing to deal with a collection of diagnostic optical discs or external USB or flash drives.

TPT Test Pattern Tool helps identify pixel anomalies in LCD panels with LED backlighting in Apple Display, iMac, MacBook, MacBook Pro, and MacBook Air systems.

UUT Unit Under Test is the customer's Mac that AST is evaluating for a possible issue.

VST Video System Test checks MacBook Pro (15-inch Late 2010) computers for intermittent display freeze issues in situations where the computer has passed all MRI tests.

System Overview

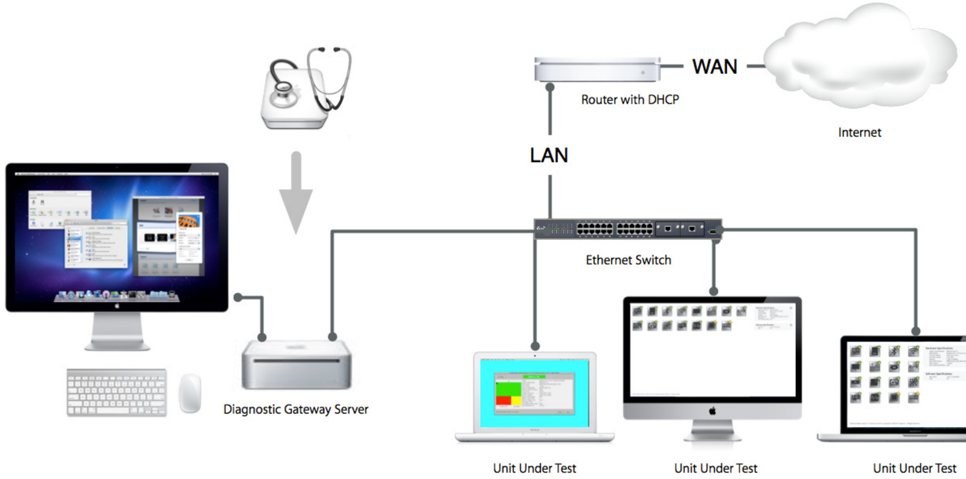
What Is Apple Service Toolkit?

Apple Service Toolkit (AST) is a time-saving triage tool. AST runs a customer-facing check of Intel-based Mac hardware components, and provides detailed diagnostic logs for review. It evaluates the condition of notebook batteries and power adapters. It identifies thermal and fan issues. It helps pinpoint pixel anomalies. AST runs on a local server, managing multiple clients via NetBoot.

System Components

The components of this tool are designed to be used as a system. AST is comprised of a NetBoot diagnostic server gateway, diagnostic tools and an application to view diagnostic logs:

- **Diagnostic Gateway (DG)** software runs on a dedicated Intel-based Mac using OS X Server 10.6 or later and provides tools to triage computers via NetBoot, recording test results as log files.
- **Mac Resource Inspector (MRI)** checks internal and external hardware in Intel-based Macs, including battery health in Intel-based Mac notebooks.
- **Notebook Adapter Diagnostic (NAD)** reports the condition of Intel-based Mac notebook power adapters.
- **Test Patterns Tool (TPT)** helps to identify pixel anomalies in LCD panels with LED backlighting in Apple Display, iMac, MacBook, MacBook Pro, and MacBook Air computers.
- **Server Bit Setter (SBS)** makes sure Mac mini and Mac Pro with OS X Server continue to be identified as servers after a logic board or backplane board replacement.
- **Cooling System Diagnostic** evaluates thermal sensors, fans and heat sinks in 2011 MacBook Pro, iMac and MacBook Air computers. It will both confirm correct operation and help diagnose a service issue. CSD is useful for assisting customers with questions about fan noise.
- **Gateway Manager (GM)** remotely configures and manages the Diagnostic Gateway server as well as accesses diagnostic logs.
- **Unit Under Test (UUT)** can be any Intel Mac desktop or portable system being tested by AST.
- **Video System Test (VST)** checks MacBook Pro (15-inch Late 2010) computers for intermittent display freeze issues in situations where the computer has passed all MRI tests.



AST Features & Benefits:

- **Speed**. AST is fast. The Apple Service Toolkit was designed to provide a quick check of the general components of the unit under test. For triage tools such as Mac Resource Inspector (MRI), you can expect results within 2–3 minutes.
- **Ease of use**. Tired of looking for CDs, DVDs, and hard disk drives? The correct version of MRI and NAD is served up automatically by the Diagnostic Gateway. In addition, several computers can be tested at the same time. All AST diagnostics are always available to your technicians from any Ethernet port on your LAN.
- **Customer-facing**. AST is designed to be run in front of the customer, enabling technicians to share the triage process with the customer. It helps technicians assess issues quickly, allowing them to provide definitive diagnostic information to the customer within minutes.

DG (Diagnostic Gateway) Features & Benefits:

- Quickly serves up diagnostic images over NetBoot for supported desktop and portable Macs.
- Supports NetBooting and serving up diagnostic tools to several UUTs simultaneously, which can improve throughput. This is useful for larger AASPs, larger Apple Retail stores, depots, etc.
- Connects to UUT(s) via your existing wired Ethernet LAN.
- Keeps logs of all MRI checks and other diagnostics across all UUTs (for a limited time), helping to identify repeat issues and to diagnose issues on 'no video' UUTs.
- Improves the feedback loop to Apple since the DG Mac is connected to the Internet.

MRI Features & Benefits:

- MRI is a very fast, EFI-based, client-side "triage" diagnostic tool that checks both hardware and software components of a UUT.
- MRI is designed to provide a quick check of the UUT's general components within 1–2 minutes.
- Since MRI is fast to start up, run, and shut down , the tech can exploit this speed to perform multiple troubleshooting cycles in rapid succession. This allows quick yet thorough troubleshooting that would not be practical any other way. For example, troubleshooting memory issues can mean complex diagnostics involving swapping DIMMs. Instead, MRI makes rapid trials practical and easy. This can result in minutes spent troubleshooting, not hours.
- Since MRI runs quickly, it is recommended for use by all technicians in just about all situations (except for safety-related issues), as part of initial UUT triage in front of the customer.
- UUTs NetBoot into MRI, so MRI does not rely on many of the UUT's internal components, such as the optical or hard drives, to be functional in order to run its checks. MRI relies only on the UUT having a good power supply and Ethernet port.
- MRI runs strictly in EFI, eliminating the possibility of OS issues causing (or masking) symptoms.
- MRI improves fault isolation (decreases the likelihood of multiple-part repairs).
- To balance diagnostic accuracy and depth with speed, MRI runs quick RAM tests, but not lengthy, "extended" tests. MRI should find the most common RAM issues.

How MRI Works:

- MRI checks internal components to see if they are 'alive' and communicating with the CPU.
- Using the configuration code, which is part of the computer's serial number, MRI compares a list of internal components identified as 'alive' against the expected configuration for that UUT.
- MRI identifies missing (i.e., disconnected, malfunctioning or dead) components in valid configurations, helping to direct troubleshooting in the right direction.
- MRI can also identify incorrect/invalid configurations (e.g., components added / changed / removed / modified after-market, etc.), which can be very useful for troubleshooting with component isolation.

AST Component Compatibility Chart

AppleCare Name	MRI	NAD	TPT	CSD standard	CSD extended	SBS	VST
Intel iMac models (2006–2010)	●		●				
iMac (Mid and Late 2011)	●		●	●			
MacBook models (2006–2010)	●	●	●				
MacBook Pro models (2006–2010)	●	●	●				
MacBook Pro (15-inch, Mid 2010)	●	●	●				●
MacBook Pro (Early and Late 2011)	●	●	●	●	●		
MacBook Air models (2008–2010)	●	●	●				
MacBook Air (Mid 2011)	●	●	●	●	●		
Intel Mac mini models (2006–2009)	●						
Mac mini & Mac mini Server models (Late 2009–Mid 2011)	●					●	
Mac Pro models (2006–2009)	●						
Mac Pro (Mid 2010) & Mac Pro (Mid 2010) with Mac OS X Server	●					●	

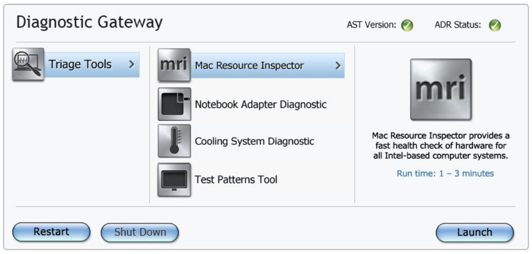
Expectations For Use: Workflow

1. Install and configure AST software to run on a DG Mac (a dedicated Mac or an existing NetBoot server on your LAN subnet). Authenticate the AST server to communicate to Apple Diagnostic Repository. This is a one-time process when first setting up AST.

   AST can be NetBooted from any Mac connected to any Ethernet port on your LAN. AST has been tested to support 60+ UUTs simultaneously NetBooted from a single Mac mini DG.

2. When a customer's Mac comes in for service, connect it as a UUT to the LAN with an Ethernet cable, and NetBoot the UUT to launch and run AST diagnostics. You can connect multiple UUTs to the LAN for 'depot' or 'batch' style troubleshooting. However, to maximize triage effectiveness and efficiency, run AST diagnostics on customer's computer live while discussing the computer's issue(s) with the customer.

3. At the Diagnostic Gateway menu, select MRI.

   Mac Resource Inspector provides a fast health check of hardware for all Intel-based computer systems.

   Run time: 1 – 3 minutes

   Important Note: You should always run MRI first—regardless of the issue—to check all subsystems and components within the UUT. Note that MRI performs a thorough check of the battery in Apple portables.

4. If you suspect a power adapter issue with a portable, run the Notebook Adapter Diagnostic (NAD) *after* running MRI. Simply restart the UUT and select NAD from the menu.

5. If you suspect pixel anomalies, run the Test Patterns Tool.

6. If you suspect overheating or fan issues in MacBook Pro (Early and Late 2011), iMac (Mid and Late 2011), or MacBook Air (Mid 2011) computers, run Cooling System Diagnostic.

7. When you are done running AST, shut down the UUT and disconnect the Ethernet cable.

8. Continue targeted troubleshooting of the customer's issue, focusing your efforts on isolating the issue to the symptoms of the failed component(s) or subsystem(s) first.

9. If all AST diagnostic checks pass, and no failures or cautions are indicated, then focus on software / OS troubleshooting steps, since the issue is less likely to be hardware-related.

   The entire process should take no more than a few minutes from check-in to initial diagnosis.

AST Support

- Latest AST download links and documentation: http://support.apple.com/kb/HT4595

AST Diagnostic Gateway Network Requirements

This section focuses on configuring AST and the DG within one of several network configurations, depending on the features and complexity of your existing network. In all of the scenarios, your existing network must meet the following requirements:

- The acronym LAN (Local Area Network) is used synonymously with a TCP/IP subnet (or broadcast domain).
- The DG and UUT LAN are connected to the Internet through an existing router and ISP broadband service (cable modem, DSL, etc.).
- The existing router or DHCP server (may be the same device) serves IP addresses to LAN hosts via DHCP to LAN. (AirPort base stations and most third-party routers already do this.)
- The WAN reaches the Internet with no proxies for typical HTTP (port 80) traffic.
- The router can be an AirPort Base Station / Time Capsule, or third-party, wired/wireless router.

Note: If you do not have an existing DHCP server on your LAN (for example, if you use manual IP addresses throughout your LAN), you will need to install and configure a DG Mac for both NetBoot and DHCP services to support NetBooting into AST diagnostics.

In this case, follow instructions in the section titled DHCP Server Configuration to configure the DG Mac to serve up IP addresses that are compatible with your LAN subnet and are also in a range that does not conflict with your existing manual IP addresses.

Important: You may need to consult your network administrator for assistance. Specific instructions for alternate or more complex network scenarios are beyond the scope of this document. For more information about OS X Server and NetBoot service, please refer to the following Apple support documentation:

- **OS X Server Guides**:
  http://www.apple.com/server/macosx/resources/documentation.html
- **Lion Server: Advanced Administration**:
  https://help.apple.com/advancedserveradmin/mac/10.7/
- **System Imaging & Software Update Admin for Mac OS X Server v10.6 Snow Leopard**:
  http://manuals.info.apple.com/en_US/SystemImage_v10.6.pdf

Important: The DG Mac must be connected to an active Ethernet LAN at all times during operation. Here are some tips:

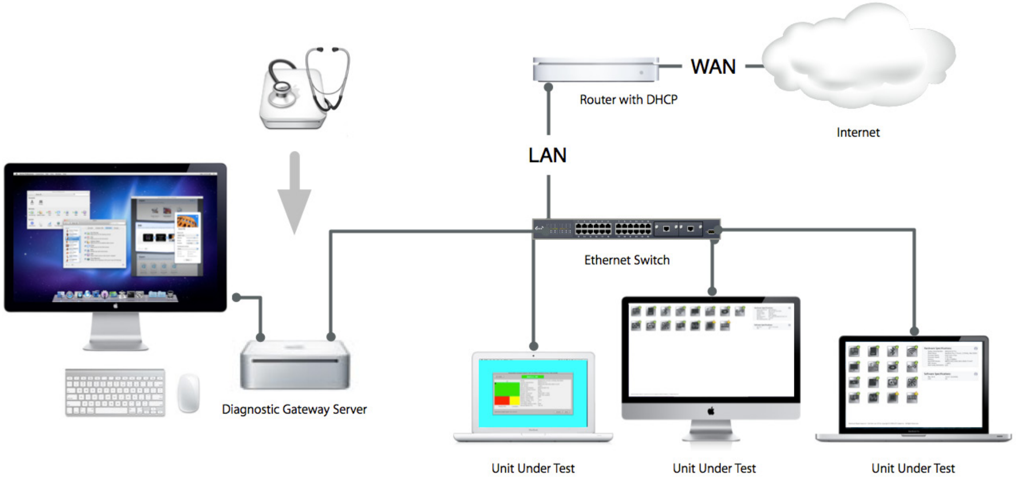
- Do not disconnect the DG Mac from the LAN while the DG Mac is operating.
- Do not directly connect the DG Mac to a UUT without using a hub in between the two; otherwise unexpected issues may occur.
- UUT Macs should stay connected to the LAN while the diagnostic process is in progress.

Important: AST can be installed on a single, existing NetBoot server, as long as AST is configured to be the default NetBoot image for that server. AST NetBoot services should not be used on a LAN with multiple NetBoot servers. UUTs may not reliably select the AST DG from which to NetBoot and may instead randomly select one of the other NetBoot servers on that LAN.

Scenario 1: No other NetBoot servers on LAN subnet

The primary advantage of this configuration is that it makes use of your existing LAN, so AST diagnostics will be available to any Ethernet port on your entire LAN. This can be useful at your service counter and on the bench if these locations have Ethernet access to this LAN.

Mac Network Configuration Scenario 1



1. Follow the steps in the section titled How to Install and Configure a Dedicated Mac for DG Use to install and configure OS X Server on your dedicated DG Mac.
2. Follow the steps in the section titled NetBoot Server Configuration to install AST software and configure your DG Mac for NetBoot service.
3. Skip the section titled DHCP Server Configuration. No DHCP service is needed from the DG Mac in this scenario since you already have an existing DHCP server on your LAN subnet.

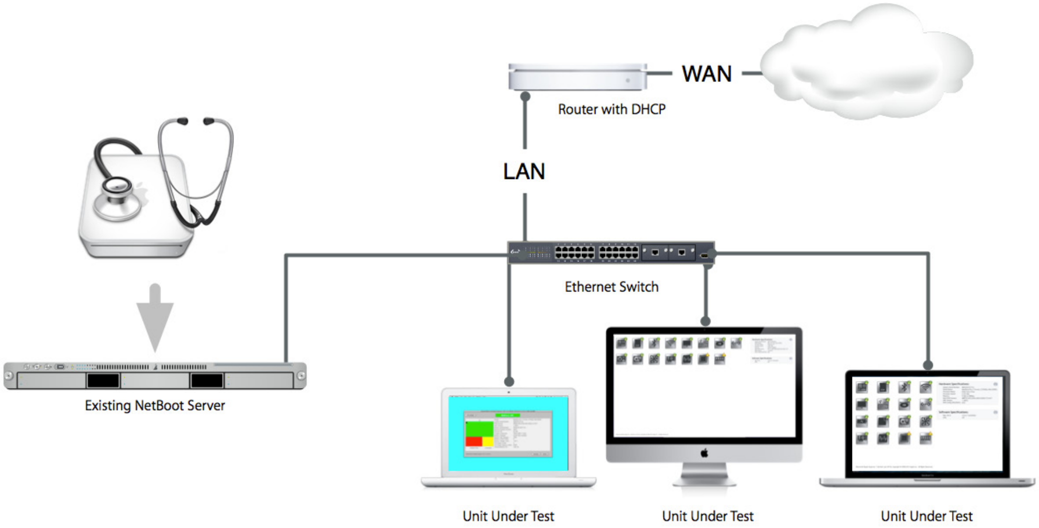
Note: If you do not have an existing DHCP server on your LAN (i.e., if you use manual IP addresses throughout your LAN), you will need to configure the DG Mac for DHCP service to support NetBooting into AST diagnostics. Follow instructions in the section titled DHCP Server Configuration to configure the DG Mac to serve up IP addresses that are compatible with your LAN subnet and are also in a range that does not conflict with your existing manual IP addresses. You may need to consult your network administrator for assistance. Specific instructions for alternate or more complex network scenarios are beyond the scope of this document.

Scenario 2: One existing Apple NetBoot server on subnet

If you can access and install AST software on your existing NetBoot server, you will not need a separate DG Mac on your LAN. This is represented in the network diagram below:

The primary advantage of this configuration is that it makes use of the NetBoot server you already have available, as well as your existing LAN, so AST diagnostics will be available to any Ethernet port on your entire LAN. This can be useful at your service counter and on the bench if these locations have Ethernet access to this LAN.

DG Mac Network Configuration Scenario 2



1. Follow the steps in the section titled NetBoot Server Configuration to install AST software and configure your existing NetBoot Server for NetBoot service.

2. Skip the section titled DHCP Server Configuration. No DHCP service is needed from the DG Mac in this scenario since you already have an existing DHCP server on your LAN subnet.

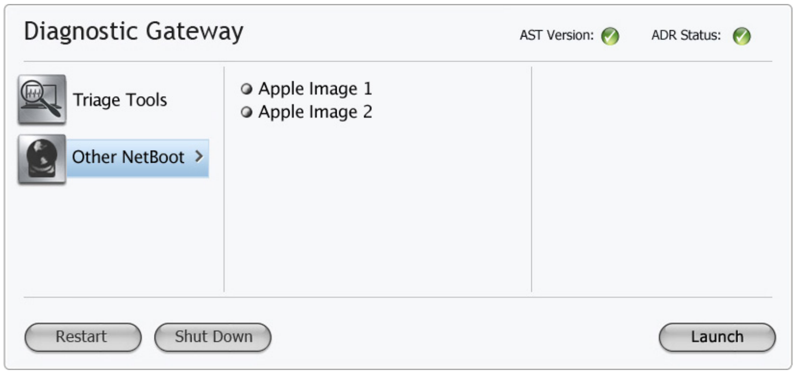
   Note: Instructions for using a third-party NetBoot server (such as a PC 'Ghost' server) are beyond the scope of this document, since AST is only compatible with NetBoot services running OS X Server 10.6 or later. These instructions assume you already have an existing NetBoot server running OS X Server 10.6 or later on your LAN.

   In this configuration, when AST software is installed, your existing NetBoot server becomes your Diagnostic Gateway (DG) for AST.

3. Install your other NetBoot images in the same folder as the AST image (/library/netboot/netbootsp0/).

4. Assign appropriate index numbers so each image's index number is unique. Instructions for doing this are listed in the NetBoot Server Configuration section.

5. When you start up a UUT via NetBoot from this DG, you will see an additional selection from the main screen, titled 'Other NetBoot.' Select this to start your UUT from another NetBoot image on this same DG.



Note: It is beyond the scope of this document to provide instructions on how to create and manage NetBoot images. Please see relevant OS X Server documentation for this information.

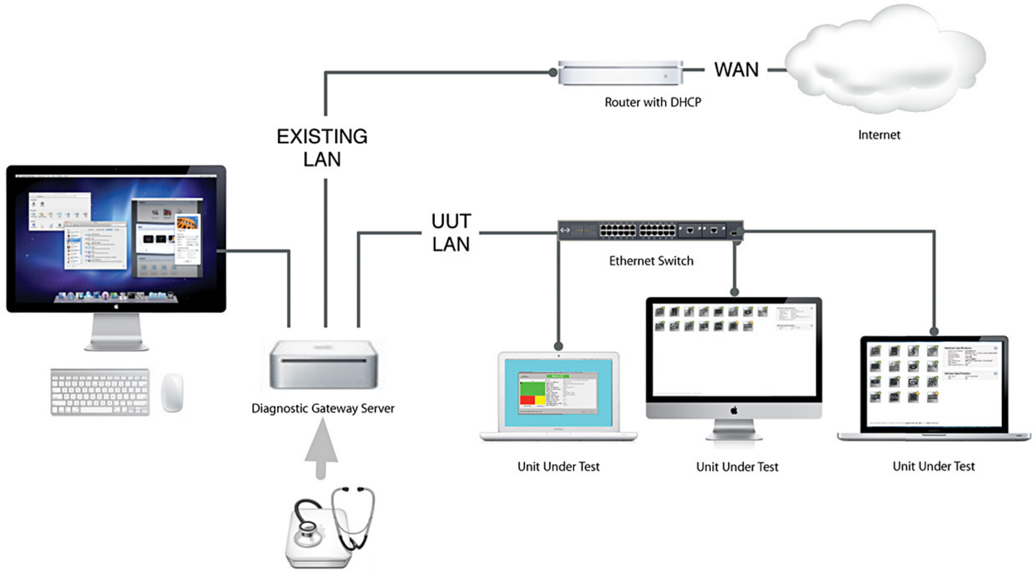
Scenario 3: Isolated UUT (Unit Under Test) network required

The advantage of this configuration is that it establishes an isolated network just for UUTs, while the DG Mac remains connected to the Internet. This prevents UUTs from having Internet connectivity during AST testing for security purposes, while allowing Gateway Manager to remain authenticated to the Apple Diagnostic Repository for test result log transmissions.

For this scenario, you will need a Mac with two Ethernet ports. Use the primary Ethernet port to connect to your existing LAN with Internet connectivity. Configure the second Ethernet port to provide NetBoot and DHCP services solely for an isolated UUT-only LAN.

Mac Pro and Xserve both have dual built-in Ethernet ports. You can use AirPort wireless to establish your primary Internet connection, allowing you to use the built-in Ethernet port for your isolated UUT LAN. You can also use the USB to Ethernet adapter on any current Mac to establish a second Ethernet port. Configure the port like any other built-in Ethernet port, using Network Preferences.

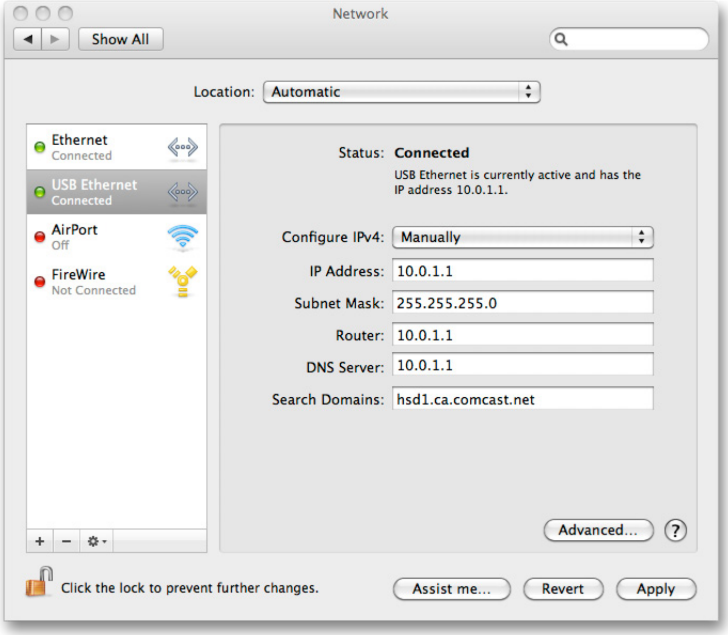
DG Mac Network Configuration Scenario 3



1. Follow the steps in the section titled How to Install and Configure a Dedicated Mac for DG Use to install and configure OS X Server on your dedicated DG Mac.

2. Open Network Preferences on the Diagnostic Gateway Mac and configure the second Ethernet port (the USB Ethernet port in the example following) with a fixed 10.0.1.1 IP address to connect to the 10.0.1.x LAN for its isolated UUT network. The DNS search domain in the example following should be replaced by your DNS information.

DG Mac Network Configuration Scenario 3



Location: Automatic

- Ethernet — Connected
- USB Ethernet — Connected
- AirPort — Off
- FireWire — Not Connected

Status: **Connected**

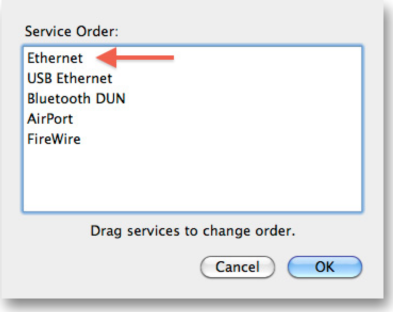
USB Ethernet is currently active and has the IP address 10.0.1.1.

Configure IPv4: Manually
IP Address: 10.0.1.1
Subnet Mask: 255.255.255.0
Router: 10.0.1.1
DNS Server: 10.0.1.1
Search Domains: hsd1.ca.comcast.net

Click the lock to prevent further changes.

3. Configure the primary Ethernet port to connect to your existing LAN with Internet access. Contact your network administrator to determine appropriate settings for this port.

4. Make sure the primary Ethernet port (the port with Internet connectivity) is assigned the highest priority in Network Preferences. It should be the top-most entry listed. This ensures that Gateway Manager can still reach and authenticate to the Apple Diagnostic Repository.
   - Choose Apple menu > System Preferences, and click Network.
   - Choose Set Service Order from the Action pop-up menu (looks like a gear).
   - Drag the primary Ethernet port (en0) to the top of the list. **NOTE**: If your DG Mac uses AirPort as its primary Internet connection, drag AirPort to the top of the list.
   - Click OK, and then click Apply to make the new settings active.



Service Order:

Ethernet
USB Ethernet
Bluetooth DUN
AirPort
FireWire

Drag services to change order.

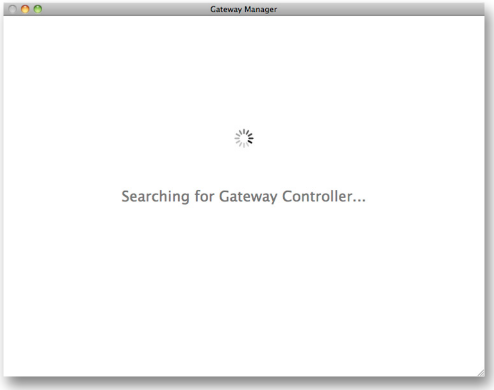
5. Determine which Ethernet port is assigned to each BSD Device Name, designated as en0, en1, en2, and so on. For example, the primary built-in Ethernet port is designated as en0. Locate this information in the Network section of System Profiler on the DG Mac.
   - Ensure that en0 is used as the primary Ethernet port with Internet connectivity.
   - Mac Pro and Xserve computers have two Ethernet ports. The BSD Device Names of en0 and en1 are used for the two Ethernet interfaces. If a Mac Pro also has an AirPort interface, the AirPort BSD Device Name will be en2.
   - MacBook Air computers use a BSD Device Name of en0 for their AirPort interface. If you use a MacBook Air as your Diagnostic Gateway, connect the Apple USB to Ethernet Adapter, which will be assigned en1.
   - If the DG Mac has AirPort, do not use this port for your UUT isolated LAN. Only use AirPort for your primary Internet connection.
   - If you have added a second Ethernet port using the Apple USB to Ethernet Adapter, assign en1 or en2 to this port, depending on whether the DG Mac has AirPort.

   Note: Use this information when configuring NetBoot and DHCP services on the DG Mac so that these services are only enabled on the isolated UUT LAN—not on the primary LAN that reaches the Internet.

6. Follow the steps in the section titled NetBoot Server Configuration to install AST software, and configure your DG Mac for NetBoot service over the UUT LAN only (not en0).

7. Follow the steps in the section titled DHCP Server Configuration to configure your DG Mac for DHCP service over the UUT LAN only (not en0).

8. The UUT LAN interface from the DG Mac must remain connected to an active Ethernet switched hub which should be powered on at all times so that UUTs can reach the DG Mac when they NetBoot. If this Ethernet link is broken for any reason (e.g., Ethernet cable or USB-to-Ethernet adapter becomes disconnected, Ethernet hub loses power, etc.). You may see the following error message when attempting to launch Gateway Manager.
   - Click OK, and then click Apply to make the new settings active.



Searching for Gateway Controller...

Caution: To avoid connectivity issues, only activate DHCP services on a network that does not have DHCP enabled. Do not activate DHCP services on a network with an existing DHCP server.

How to Configure a Mac for DG Use

This section describes the steps necessary to set up a dedicated Mac for use as a Diagnostic Gateway with AST and UUTs. AST software works together with OS X Server NetBoot and any existing DHCP services to provide the Diagnostic Gateway and NetBoot server functionality.

Requirements to Install DG:

- Mac desktop or portable with 64-bit Intel processor
    - **Note**: AST must be run on a 64-bit-capable Mac. Please see Apple Support article HT3696: How to tell if your Intel-based Mac has a 32-bit or 64-bit processor.
- OS X Server v10.6 (Snow Leopard) or later, with serial number
- Connected or built-in display (optional, see note below)
- At least 60GB of available disk space
- At least 2GB of RAM
- AST installation software

Tips

- Any Mac that meets the requirements above can serve as the DG. Consider which form factor works best for you: iMac, Mac Pro, MacBook, MacBook Pro, Mac mini, or Xserve.
- When running AST the first few times, you should initially set up and use the DG Mac with a display connected so you can verify that the DG is working properly. When you become familiar with the entire process, you can easily view UUT log files using Gateway Manager from any Mac on the LAN.
- One suggested DG form factor is a Mac mini. Once the DG is installed and configured, the DG can run unattended and even headless (no display). Because it is not directly involved in the diagnostic process, you can place the DG Mac somewhere out of the way, yet reachable by a UUT over the LAN with an RJ-45 cable. Its involvement with AST diagnostics is restricted to serving up the NetBoot image over the LAN.
- If you leave DG headless, do one of the following so you can remotely run Gateway Manager and examine UUT logs from another Mac on this same LAN:
    - Enable screen sharing on the DG Mac and run Gateway Manager from it.
    - Install Gateway Manager software on another Mac running OS X v10.6 or later (client or server version) that is connected to the same LAN as the DG Mac, and run Gateway Manager from that Mac. Gateway Manager does not need to be run from the DG Mac.

Installing OS X Server v10.6 Snow Leopard on the DG Mac

This section provides instructions for installing and configuring OS X Server 10.6 on a dedicated Mac to be used as the Diagnostic Gateway.

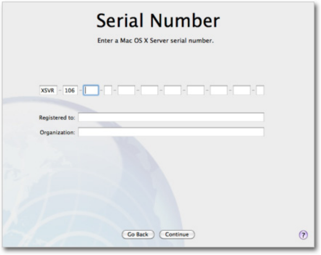
For OS X Lion Server, skip to the next section: Installing OS X Lion Server 10.7 on the DG Mac.

1. Connect a Mac desktop or portable that can be dedicated for this purpose to an Ethernet LAN port that can reach the Internet. Please see the section titled AST Diagnostic Gateway System Networking Requirements for complete instructions.

   Important: You must connect the Mac to the Ethernet switched hub with an Ethernet cable, and apply power to the switched hub before you can set up OS X Server. Server Configuration Assistant will not allow you to continue without an active network connection, also known as an Ethernet "link."

   Note: If you have purchased a Mac that has OS X Server already installed, such as Xserve or some models of Mac mini, then you can skip step 2 below and proceed to server configuration on step 3.

2. Install OS X Server v10.6 (Snow Leopard) or later on this Mac. You will need a valid OS X Server Serial Number (begins with XSVR-...)


Serial Number

Enter a Mac OS X Server serial number.

Initial Server Configuration Using OS X Server v10.6 Snow Leopard

3. Start up the DG Mac into OS X Server and complete the initial configuration of the server. (Go through Server Configuration Assistant screens as follows; press the Continue button at the bottom of the window after each configuration step to advance to the next step):

   Skip the following steps:

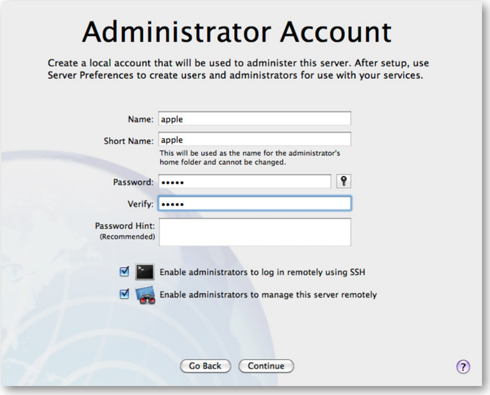
   - Transfer data from another Mac
   - User Registration (either complete registration or use Command-Q to skip registration)

4. Select the appropriate time zone for your area.

5. Create initial Admin user account. Suggested username: apple / password: apple.

   Note: You do not need to add any additional user accounts on this server; this is the only account you will need on the DG Mac.

6. Leave the two checkboxes checked for 'Allow remote admin' and 'Enable SSH.'



Administrator Account

Create a local account that will be used to administer this server. After setup, use Server Preferences to create users and administrators for use with your services.

Name: apple

Short Name: apple

This will be used as the name for the administrator's home folder and cannot be changed.

Password: •••••

Verify: •••••

Password Hint: (Recommended)

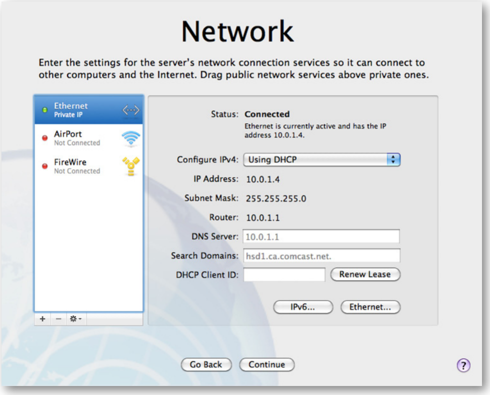
☑ Enable administrators to log in remotely using SSH

☑ Enable administrators to manage this server remotely

7. TCP/IP Configuration

Configure the DG Mac with an automatically-assigned IP address using DHCP

- Interface: Ethernet (en0)
- Configure IPv4: Using DHCP



Network

Enter the settings for the server's network connection services so it can connect to other computers and the Internet. Drag public network services above private ones.

Ethernet Private IP

AirPort Not Connected

FireWire Not Connected

Status: Connected

Ethernet is currently active and has the IP address 10.0.1.4.

Configure IPv4: Using DHCP

IP Address: 10.0.1.4

Subnet Mask: 255.255.255.0

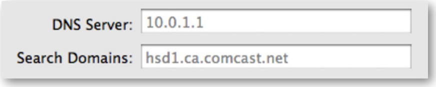
Router: 10.0.1.1

DNS Server: 10.0.1.1

Search Domains: hsd1.ca.comcast.net.

DHCP Client ID:

8. The 'DNS Server' and 'Search Domains' parameters should be automatically configured by your existing router via DHCP. You can check this by looking at the DG Mac's Network System Preference pane. Certain parameters, such as DNS server and search domain, should auto-populate with information shown in light text that disappears when you click into each field.

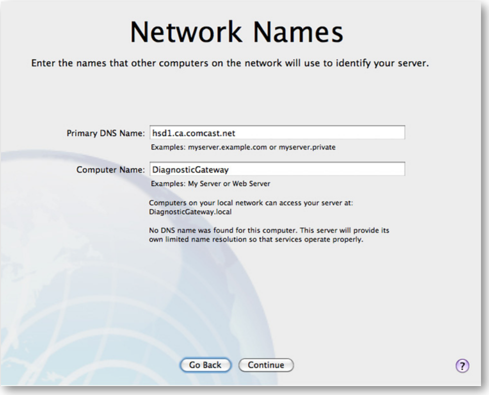


DNS Server: 10.0.1.1

Search Domains: hsd1.ca.comcast.net

If your existing DHCP server does not serve up all these parameters, then you may need to manually configure them, which means you may need to consult your network administrator for assistance. Instructions for alternate or more complex network scenarios are beyond the scope of this document.

9. Network Names:
   - **Primary DNS Name**: Enter the name that is displayed in the Search Domains field from the previous step. The DNS name in the example below should be replaced by your DNS information.
   - **Computer Name**: DiagnosticGateway


Network Names

Enter the names that other computers on the network will use to identify your server.

Primary DNS Name: hsd1.ca.comcast.net

Examples: myserver.example.com or myserver.private

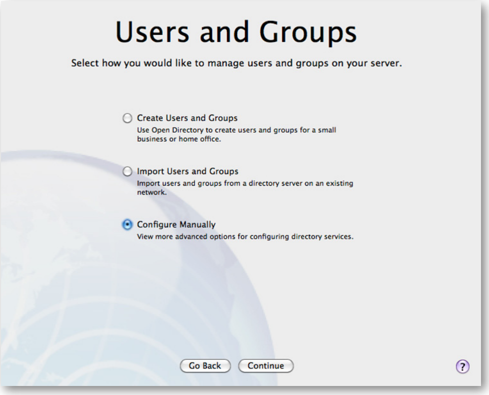
Computer Name: DiagnosticGateway

Examples: My Server or Web Server

Computers on your local network can access your server at:
DiagnosticGateway.local

No DNS name was found for this computer. This server will provide its own limited name resolution so that services operate properly.

10. Users and Groups: Select 'Configure Manually' and click Continue.


Users and Groups

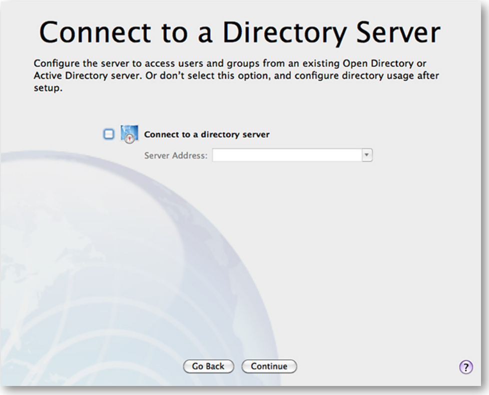
Select how you would like to manage users and groups on your server.

○ Create Users and Groups
Use Open Directory to create users and groups for a small business or home office.

○ Import Users and Groups
Import users and groups from a directory server on an existing network.

● Configure Manually
View more advanced options for configuring directory services.

11. Connect to a Directory Server: Leave unselected and click Continue.

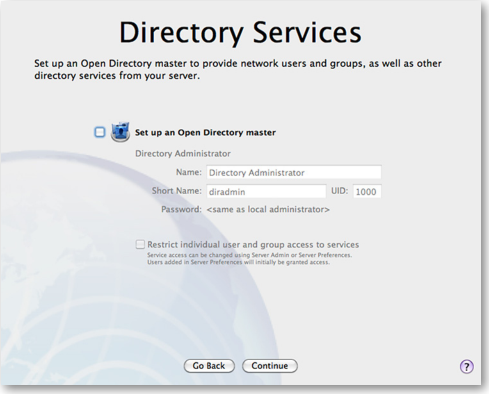

Connect to a Directory Server

Configure the server to access users and groups from an existing Open Directory or Active Directory server. Or don't select this option, and configure directory usage after setup.

☐ Connect to a directory server

Server Address:

12. Set up an Open Directory master: Leave unselected and click 'Continue'.



Directory Services

Set up an Open Directory master to provide network users and groups, as well as other directory services from your server.

☐ Set up an Open Directory master

Directory Administrator

Name: Directory Administrator

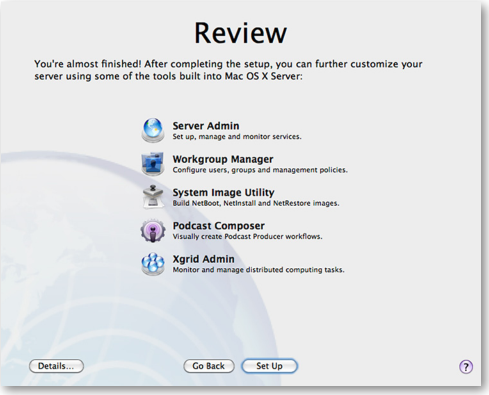
Short Name: diradmin UID: 1000

Password: <same as local administrator>

☐ Restrict individual user and group access to services

Service access can be changed using Server Admin or Server Preferences. Users added in Server Preferences will initially be granted access.

13. Click 'Setup' to finish server configuration (shown below). Then skip past the next section—Installing OS X Lion Server 10.7 on the DG Mac—and go on to Using Server Admin.



Review

You're almost finished! After completing the setup, you can further customize your server using some of the tools built into Mac OS X Server:

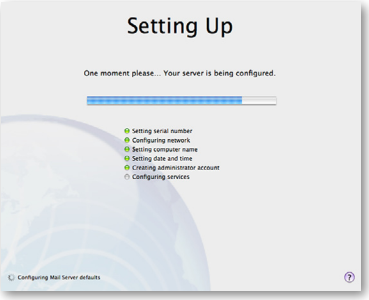
Server Admin
Set up, manage and monitor services.

Workgroup Manager
Configure users, groups and management policies.

System Image Utility
Build NetBoot, NetInstall and NetRestore images.

Podcast Composer
Visually create Podcast Producer workflows.

Xgrid Admin
Monitor and manage distributed computing tasks.

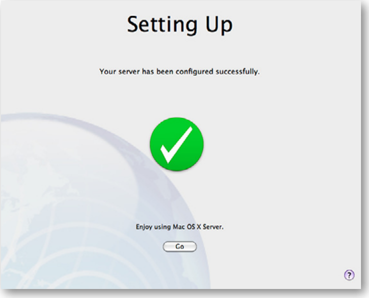


Setting Up

One moment please... Your server is being configured.

● Setting serial number
● Configuring network
● Setting computer name
● Setting date and time
● Creating administrator account
○ Configuring services

Configuring Mail Server defaults



Setting Up

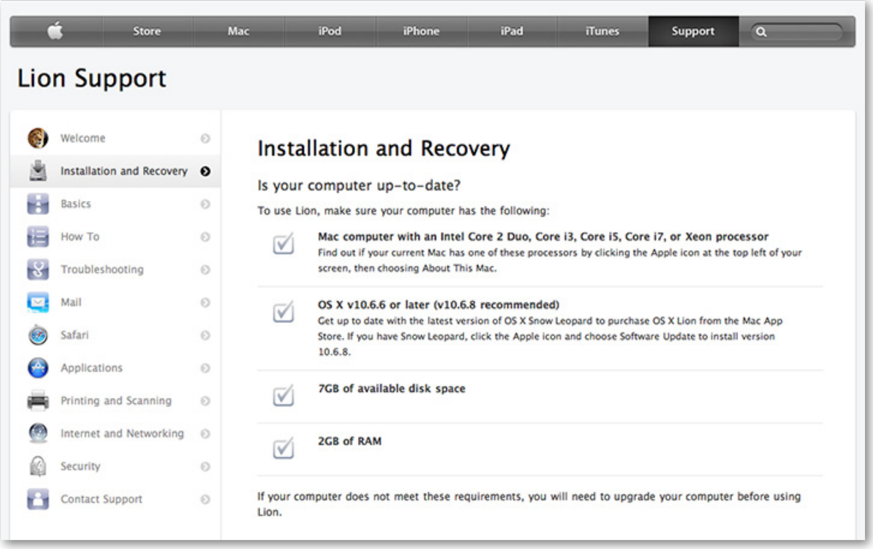
Your server has been configured successfully.

Enjoy using Mac OS X Server.

Installing OS X Lion Server 10.7 on the DG Mac

For in-depth instructions, see http://www.apple.com/support/lionserver/setupadministration/.

1. Install OS X Lion.
    - Check requirements on http://www.apple.com/support/lion/installrecovery/.



Lion Support

Installation and Recovery

Is your computer up-to-date?

To use Lion, make sure your computer has the following:

☑ **Mac computer with an Intel Core 2 Duo, Core i3, Core i5, Core i7, or Xeon processor**
Find out if your current Mac has one of these processors by clicking the Apple icon at the top left of your screen, then choosing About This Mac.

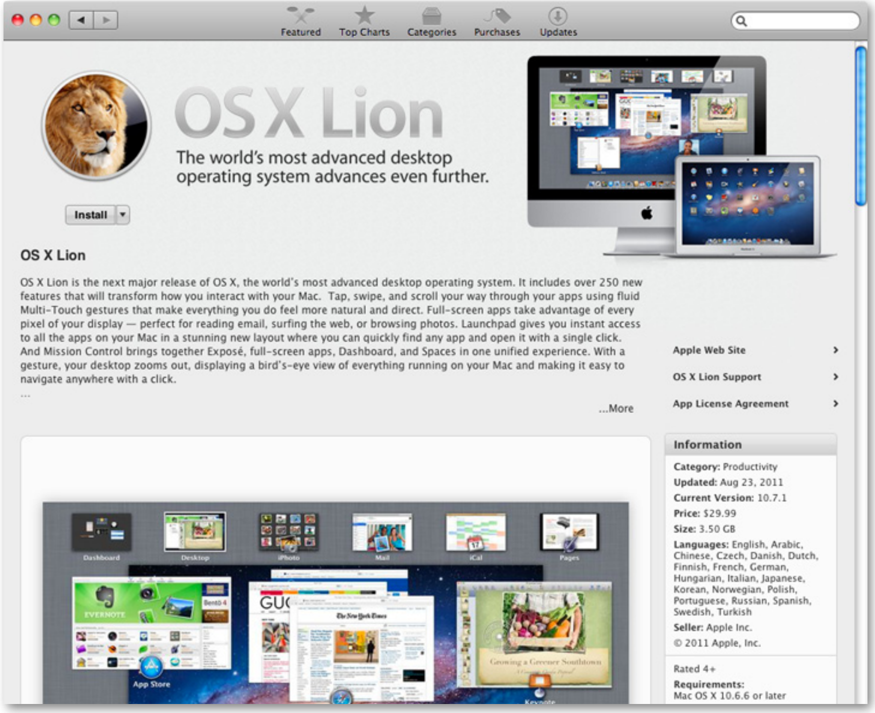
☑ **OS X v10.6.6 or later (v10.6.8 recommended)**
Get up to date with the latest version of OS X Snow Leopard to purchase OS X Lion from the Mac App Store. If you have Snow Leopard, click the Apple icon and choose Software Update to install version 10.6.8.

☑ **7GB of available disk space**

☑ **2GB of RAM**

If your computer does not meet these requirements, you will need to upgrade your computer before using Lion.

- Follow steps in http://www.apple.com/macosx/how-to-buy/ to purchase and install OS X Lion client.



The world's most advanced desktop operating system advances even further.

OS X Lion

OS X Lion is the next major release of OS X, the world's most advanced desktop operating system. It includes over 250 new features that will transform how you interact with your Mac. Tap, swipe, and scroll your way through your apps using fluid Multi-Touch gestures that make everything you do feel more natural and direct. Full-screen apps take advantage of every pixel of your display — perfect for reading email, surfing the web, or browsing photos. Launchpad gives you instant access to all the apps on your Mac in a stunning new layout where you can quickly find any app and open it with a single click. And Mission Control brings together Exposé, full-screen apps, Dashboard, and Spaces in one unified experience. With a gesture, your desktop zooms out, displaying a bird's-eye view of everything running on your Mac and making it easy to navigate anywhere with a click.
...

...More

Apple Web Site ›
OS X Lion Support ›
App License Agreement ›

Information

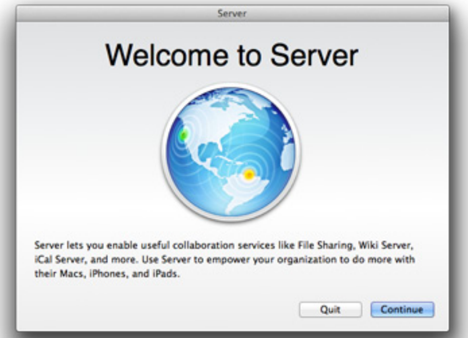
Category: Productivity
Updated: Aug 23, 2011
Current Version: 10.7.1
Price: $29.99
Size: 3.50 GB
Languages: English, Arabic, Chinese, Czech, Danish, Dutch, Finnish, French, German, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese, Russian, Spanish, Swedish, Turkish
Seller: Apple Inc.
© 2011 Apple, Inc.

Rated 4+
Requirements:
Mac OS X 10.6.6 or later

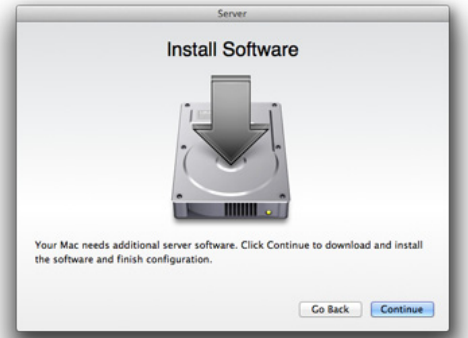
2. Configure network settings during Lion setup to ensure your gateway can reach the Internet.

3. Complete all required software updates.

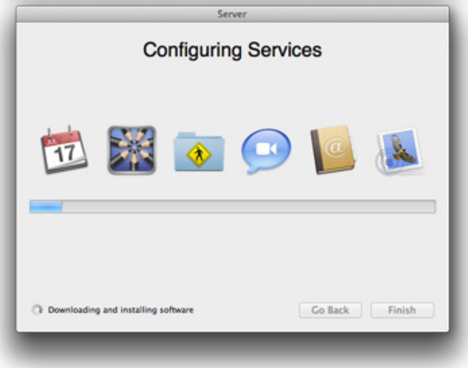
4. Download and install OS X Lion Server.
    - Check requirements on http://www.apple.com/support/lion/installrecovery/.
    - Follow steps in http://www.apple.com/macosx/how-to-buy/ to purchase and install OS X Lion Server.

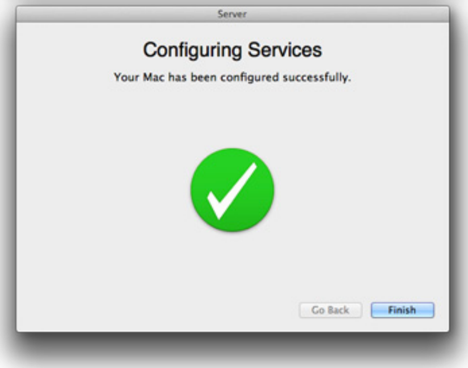


Server lets you enable useful collaboration services like File Sharing, Wiki Server, iCal Server, and more. Use Server to empower your organization to do more with their Macs, iPhones, and iPads.



Your Mac needs additional server software. Click Continue to download and install the software and finish configuration.



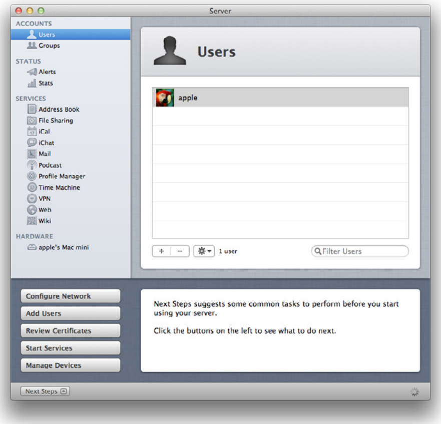


Your Mac has been configured successfully.

5. To upgrade from an earlier version of OS X Server, see Lion Server: Upgrading and Migrating at manuals.info.apple.com.

Lion Server
Upgrading and Migrating
For Mac OS X v10.7 Lion Server

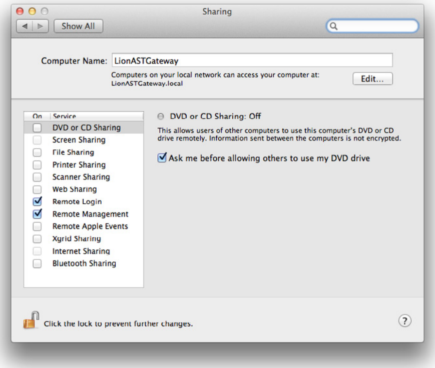
6. When the following setup screen appears, the installation of OS X Lion Server is complete.



Next Steps suggests some common tasks to perform before you start using your server.

Click the buttons on the left to see what to do next.

7. Go to System Preferences > Sharing to rename your DG Mac:'LionASTGateway.'



Computer Name: LionASTGateway

Computers on your local network can access your computer at: LionASTGateway.local

☐ DVD or CD Sharing
☐ Screen Sharing
☐ File Sharing
☐ Printer Sharing
☐ Scanner Sharing
☐ Web Sharing
☑ Remote Login
☑ Remote Management
☐ Remote Apple Events
☐ Xgrid Sharing
☐ Internet Sharing
☐ Bluetooth Sharing

○ DVD or CD Sharing: Off

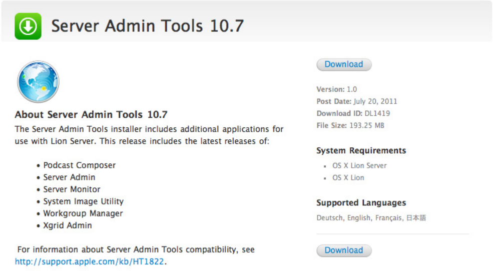
This allows users of other computers to use this computer's DVD or CD drive remotely. Information sent between the computers is not encrypted.

☑ Ask me before allowing others to use my DVD drive

Click the lock to prevent further changes.

8. Verify network settings and Internet connectivity. Make sure web pages load.

9. Download Server Admin Tools 10.7 from http://support.apple.com/kb/DL1488.



Server Admin Tools 10.7

About Server Admin Tools 10.7

The Server Admin Tools installer includes additional applications for use with Lion Server. This release includes the latest releases of:

- Podcast Composer
- Server Admin
- Server Monitor
- System Image Utility
- Workgroup Manager
- Xgrid Admin

For information about Server Admin Tools compatibility, see http://support.apple.com/kb/HT1822.

Version: 1.0
Post Date: July 20, 2011
Download ID: DL1419
File Size: 193.25 MB

System Requirements

- OS X Lion Server
- OS X Lion

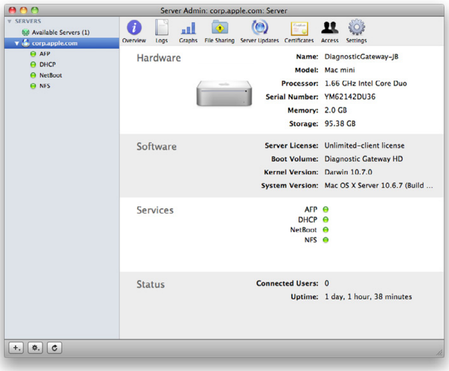
Supported Languages

Deutsch, English, Français, 日本語

10. Install Server Admin Tools 10.7. This will install several tools into a folder with the directory name and location /Applications/Server/.

Using Server Admin

1. Launch Server Admin in /Applications/Server/. If installing OS X Server v10.6 Snow Leopard, Server Configuration Assistant should launch into Finder when it is finished, then launch Server Admin (located in /Applications/Server/).

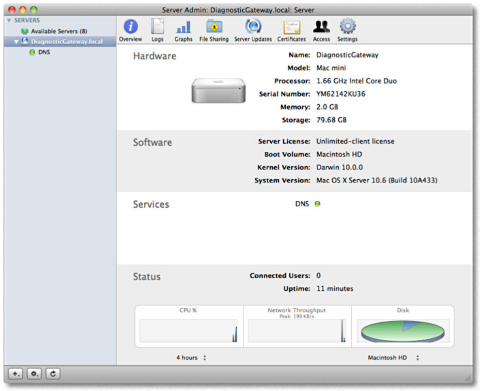


Name: DiagnosticGateway-JB
Model: Mac mini
Processor: 1.66 GHz Intel Core Duo
Serial Number: YM62142DU36
Memory: 2.0 GB
Storage: 95.38 GB
Server License: Unlimited-client license
Boot Volume: Diagnostic Gateway HD
Kernel Version: Darwin 10.7.0
System Version: Mac OS X Server 10.6.7 (Build ...
AFP ●
DHCP ●
NetBoot ●
NFS ●
Connected Users: 0
Uptime: 1 day, 1 hour, 38 minutes

2. Before continuing, verify that you have Internet connectivity on the DG Mac by using Safari to access a public website (e.g., www.apple.com). If you can freely access public websites, your DG Mac is configured properly.

   Note: If you cannot access any websites, or if you can only access public websites using their IP address rather than URL, your DNS settings on your DG Mac may be configured incorrectly. You may need to consult your network administrator for assistance. Instructions for alternate or more complex network scenarios are beyond the scope of this document.

3. In Server Admin, select the server (DiagnosticGateway.local or LionASTGateway.local) in the left pane of the Server Admin window, click the 'Settings' icon in the Server Admin tool bar, then select the Services tab and disable all services by clicking their checkboxes.



Name: DiagnosticGateway
Model: Mac mini
Processor: 1.66 GHz Intel Core Duo
Serial Number: YM62142KU36
Memory: 2.0 GB
Storage: 79.68 GB
Server License: Unlimited-client license
Boot Volume: Macintosh HD
Kernel Version: Darwin 10.0.0
System Version: Mac OS X Server 10.6 (Build 10A433)
DNS ●
Connected Users: 0
Uptime: 11 minutes

Important: The server may start DNS and/or Open Directory services and other services anyway. You may not be able to disable DNS and Open Directory services, although they should not affect operation of the DG. However, other services are not necessary and should be disabled. The only services needed on this server are NetBoot, possibly DHCP, and—if running OS X Server 10.6—Network File System (NFS) services.

Note: Lion Server does not require Network File System (NFS) configuration. In OS X Lion Server, NFS service is automatically started when NetBoot services start. See http://support.apple.com/kb/HT4745 for more information.

4. Click the NetBoot checkbox, and—for OS X Server 10.6 only—the Network File System (NFS) checkbox to enable its configuration.

   Note: While Lion does not require Network File System (NFS) configuration, you may need to also enable DHCP depending on your specific network connection.

5. At the bottom of the Server Admin window, save your settings. The NetBoot service (and NFS services for OS X Server 10.6) will appear in the left pane, ready to be configured.

   Note: If you are running OS X Lion Server, skip the next two steps.

6. In OS X Server 10.6 only, select the NFS Service in the left pane of the Server Admin window (you may need to click on the disclosure triangle).

7. Click 'Start NFS' to start NFS services. No further configuration is necessary for NFS.

NetBoot Server Configuration

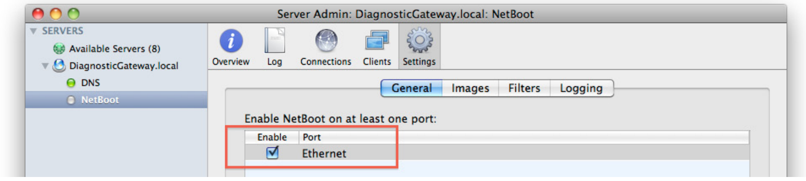
This section provides instructions for configuring NetBoot services on a DG Mac. If you are using an existing NetBoot server to host the AST NetBoot image also, please be aware that some of these steps may already be configured on your existing NetBoot server.

1. In Server Admin, configure NetBoot services by selecting the NetBoot Service in the left pane of the Server Admin window (you may need to open the disclosure triangle).

2. Click the 'Settings' icon in the Server Admin tool bar, then click the 'General' tab.

3. You will see a list of network interfaces for this Mac to serve NetBoot services (e.g. Ethernet, AirPort, FireWire, etc.). Click the 'Enable' checkbox next to the network interface that connects to the UUT network. This may be the built-in Ethernet port (en0), or it may be the second wired Ethernet interface (en1 or en2, depending on whether the DG Mac has AirPort or not).

   Note: You cannot start NetBoot services without defining a network interface from which to serve NetBoot first. This step does this.

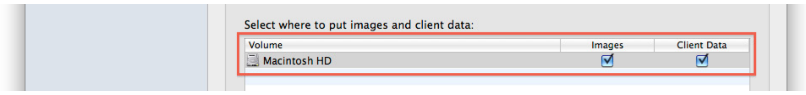


Enable NetBoot on at least one port:

Enable	Port
☑	Ethernet

4. You will see a list of volumes for this Mac to store NetBoot images and client 'shadow' data (e.g. Macintosh HD) in the lower part of the NetBoot window. Enable these settings for the 'Macintosh HD' volume by clicking both the 'Images' and 'Client Settings' checkboxes.

   Note: You cannot start NetBoot services without defining a volume where NetBoot images and client data are stored first. This step does this.



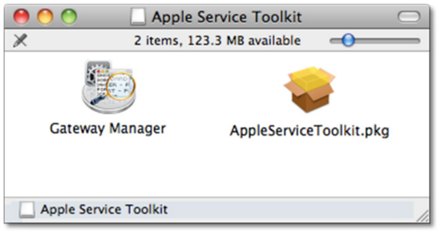
Select where to put images and client data:

Volume	Images	Client Data
Macintosh HD	☑	☑

5. At the bottom of this window, click the 'Save' button to save your settings.

   Note: You cannot start NetBoot services without installing and selecting a NetBoot image first, which the AST installer does in the next step. Leave Server Admin open while you install the DG software.

6. Download the AST software installer disc image in Apple Support article HT4595: Latest Apple Service Toolkit Download Links and Documentation. When the image is mounted and open, you will see the AST installer and the Gateway Manager application:

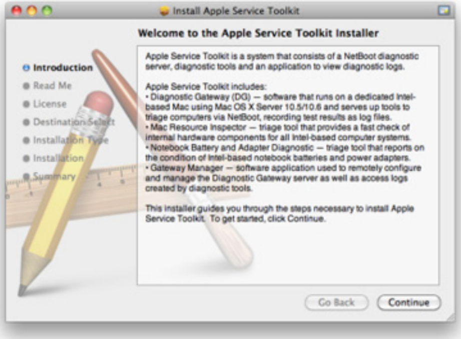


7. Run the AST installer. This puts diagnostic NetBoot images and support files in the correct locations on the server. It installs the Gateway Manager application in /Applications and the NetBoot image file on the DG Mac in /Library/NetBoot/NetBootSP0/AppleServiceToolkit.nbi.

   Note: Gateway Manager and Apple Service Toolkit versions are tied together, so make sure to use the latest version of each to ensure they work properly together.

   If you copy the Gateway Manager application to other Macs on your LAN and then update the AST software on the DG, update Gateway Manager on all other Macs so that all versions are current. If you are using multiple DGs, make sure all DGs on your LAN are using the latest version of AST software.

   See the section titled Using Multiple Diagnostic Gateways with AST for more information on how to update AST software on one or more DG Macs.

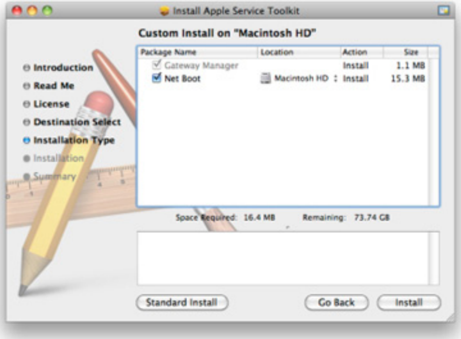


Welcome to the Apple Service Toolkit Installer

Apple Service Toolkit is a system that consists of a NetBoot diagnostic server, diagnostic tools and an application to view diagnostic logs.

Apple Service Toolkit includes:
- Diagnostic Gateway (DG) — software that runs on a dedicated Intel-based Mac using Mac OS X Server 10.5/10.6 and serves up tools to triage computers via NetBoot, recording test results as log files.
- Mac Resource Inspector — triage tool that provides a fast check of internal hardware components for all Intel-based computer systems.
- Notebook Battery and Adapter Diagnostic — triage tool that reports on the condition of Intel-based notebook batteries and power adapters.
- Gateway Manager — software application used to remotely configure and manage the Diagnostic Gateway server as well as access logs created by diagnostic tools.

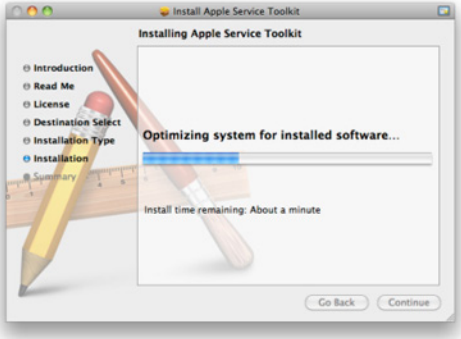
This installer guides you through the steps necessary to install Apple Service Toolkit. To get started, click Continue.



Custom Install on "Macintosh HD"

Package Name	Location	Action	Size
☑ Gateway Manager		Install	1.1 MB
☑ Net Boot	Macintosh HD	Install	15.3 MB

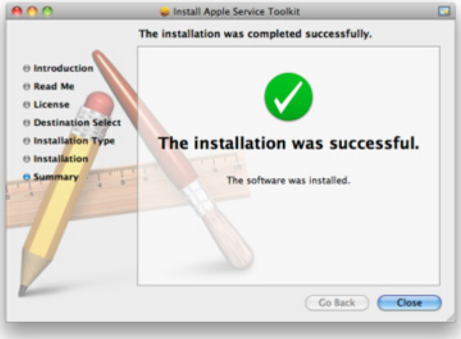
Space Required: 16.4 MB Remaining: 73.74 GB



Installing Apple Service Toolkit

Optimizing system for installed software...

Install time remaining: About a minute



The installation was completed successfully.

The installation was successful.

The software was installed.

8. Once the AST installer finishes, download all sets of AST OS image components to your DG Mac from Apple Support article [HT4595: Latest Apple Service Toolkit Download Links and Documentation].

   Note: Cooling System Diagnostic requires each set of OS images to operate from within AST:

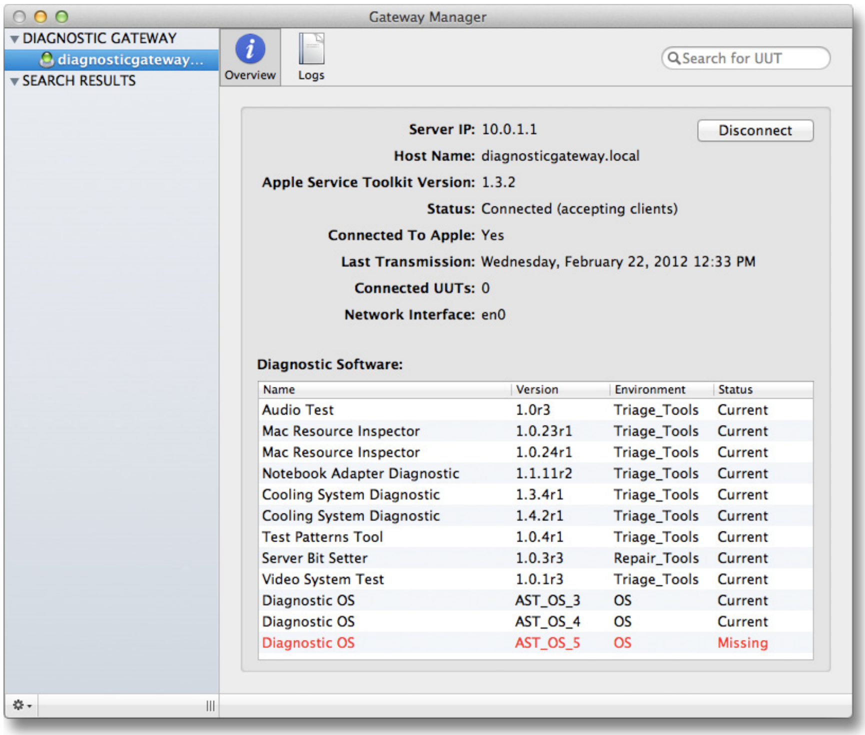
   - AST_OS_3: Diagnostic OS disc image for Snow Leopard 10.6
   - AST_OS_4: Diagnostic OS disc image for Lion 10.7
   - AST_OS_5: Diagnostic OS disc image for Lion 10.7 (for VST)

   Multiple images are required because newer Macs require Lion while older Macs can use Snow Leopard. Various versions and builds of OS X are used to support all the diagnostic components. AST will select and use the appropriate NetBoot image when running AST diagnostic tests on different Macs.

9. Assemble each set of AST OS components by double-clicking on the .001 component. See AST component chart for a list and description of all the diagnostic OS disc images available.

10. Launch each resulting AST OS installer package. Once each OS installer finishes, continue with the next step.

    NOTE: Do not miss this step. You must run multiple installers to complete AST installation (one installer for the AST software itself, plus additional installers for every OS NetBoot image that supports each additional diagnostic). If all the OS installers have not been run, you will see error messages in Gateway Manager indicating that some diagnostic components are missing or mismatched.

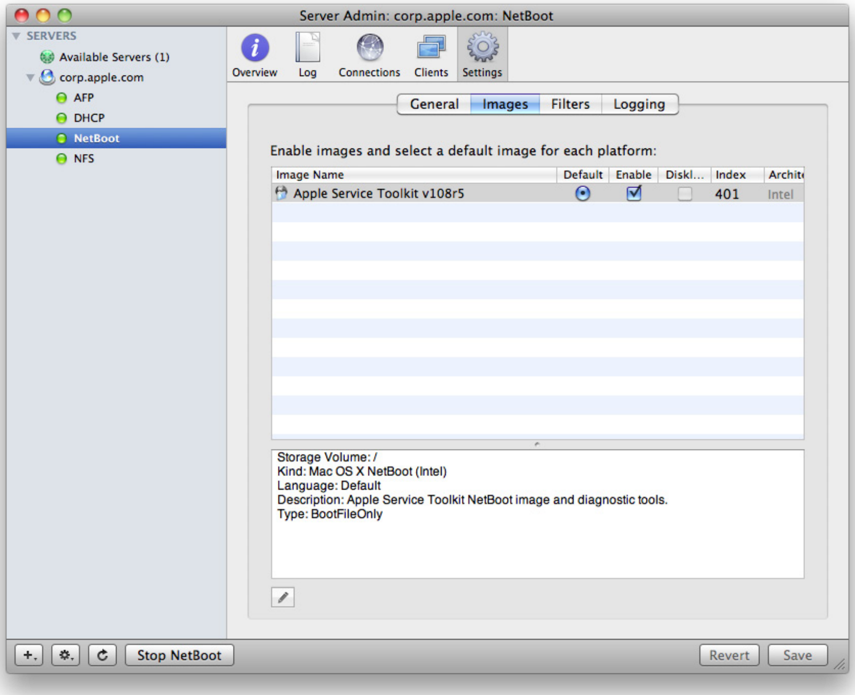


Server IP: 10.0.1.1
Host Name: diagnosticgateway.local
Apple Service Toolkit Version: 1.3.2
Status: Connected (accepting clients)
Connected To Apple: Yes
Last Transmission: Wednesday, February 22, 2012 12:33 PM
Connected UUTs: 0
Network Interface: en0

Diagnostic Software:

Name	Version	Environment	Status
Audio Test	1.0r3	Triage_Tools	Current
Mac Resource Inspector	1.0.23r1	Triage_Tools	Current
Mac Resource Inspector	1.0.24r1	Triage_Tools	Current
Notebook Adapter Diagnostic	1.1.11r2	Triage_Tools	Current
Cooling System Diagnostic	1.3.4r1	Triage_Tools	Current
Cooling System Diagnostic	1.4.2r1	Triage_Tools	Current
Test Patterns Tool	1.0.4r1	Triage_Tools	Current
Server Bit Setter	1.0.3r3	Repair_Tools	Current
Video System Test	1.0.1r3	Triage_Tools	Current
Diagnostic OS	AST_OS_3	OS	Current
Diagnostic OS	AST_OS_4	OS	Current
Diagnostic OS	AST_OS_5	OS	Missing

11. Select the NetBoot Service in the left pane of the Server Admin window, then click the 'Settings' icon in the Server Admin toolbar. On the 'Images' tab in Server Admin, ensure that the image named 'Apple Service Toolkit' is present. Also ensure that this image is selected as the default image.



Enable images and select a default image for each platform:

Image Name	Default	Enable	Diskl...	Index	Archit
Apple Service Toolkit v108r5	●	☑	☐	401	Intel

Storage Volume: /
Kind: Mac OS X NetBoot (Intel)
Language: Default
Description: Apple Service Toolkit NetBoot image and diagnostic tools.
Type: BootFileOnly

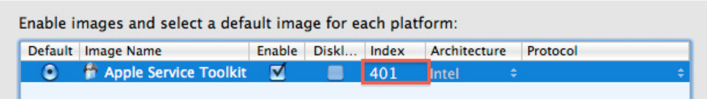
Note: AST must be selected as the default image so that UUTs can use the N key to start up to AST over the LAN, instead of using Startup Manager. This is an important feature in cases where UUTs have no video.

If you are using your existing NetBoot server as the DG, your NetBoot clients can select other NetBoot images from your server by using Startup Manager. On newer Mac configurations, holding down the Option key at startup reveals multiple, selectable NetBoot images.

12. If you are installing AST software on a dedicated Mac that you are setting up as the DG Mac, skip ahead to step 13 below. If you are installing AST software on your existing NetBoot server, perform the following two important additional steps.

Note: The following steps ensure that the AST software NetBoot image will not conflict with any other NetBoot images you may already have installed on your existing NetBoot server. This way all your existing NetBoot images will continue to be served to your LAN, with AST diagnostics simply being one additional image served.

13. Locate the 'Index' setting for the AST software NetBoot image (the image named 'Apple Service Toolkit'), as shown here:



Enable images and select a default image for each platform:

Default	Image Name	Enable	Diskl...	Index	Architecture	Protocol
●	Apple Service Toolkit	☑	☐	401	Intel	

14. Double-click the Index field to change the index number 1050 or higher, and to differentiate it from all other index numbers assigned to other NetBoot images already installed on your NetBoot server. All NetBoot image index numbers should be unique.

    Important: Make sure the index number you choose for AST is 1050 or higher. This ensures that NetBoot over multicast will work for this image.

15. At the bottom of the Server Admin window, save your settings, then click 'Start NetBoot' to start NetBoot services. The DG Mac is now completely configured for NetBoot service.

16. Follow the instructions in the section titled Gateway Manager Configuration to complete the configuration of your DG Mac. Do not attempt to use AST on your DG until Gateway Manager settings are configured and DG authentication is validated.

You can now NetBoot and run AST on UUTs using your OS X Server.

Important: Make sure you disconnect any external volumes before running CSD, or you may see a dialog asking to use your external volume as a Time Machine backup. This is because the CSD NetBoot image is OS X 10.6.x running an application called CSD.

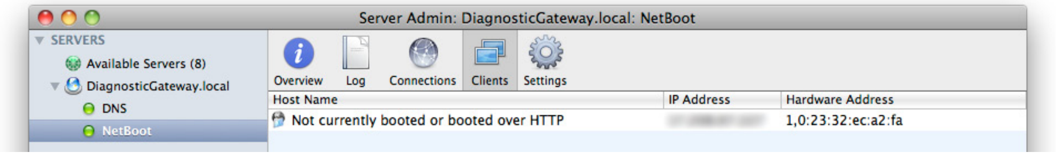
Troubleshooting Issues with DG and NetBooting UUTs

Once the DG Mac has been configured and its NetBoot services are running, any compatible UUT Mac on the same LAN subnet should be able to NetBoot from it into AST. If this does not happen, check the following settings on the DG Mac to verify that it is functioning properly.

NetBoot Log and Clients

Check the NetBoot Log and Clients icons in the Server Admin toolbar to verify that NetBoot is enabled and that a NetBoot client has been served with a NetBoot image.

For example, you should see a NetBoot client entry listed at the top, similar to the following:



Host Name	IP Address	Hardware Address
Not currently booted or booted over HTTP	[redacted]	1,0:23:32:ec:a2:fa

Gateway Manager Configuration

The Diagnostic Gateway (DG) must be connected to the Internet to send UUT log information to Apple Diagnostic Repository (ADR). To ensure connectivity, three requirements must be met:

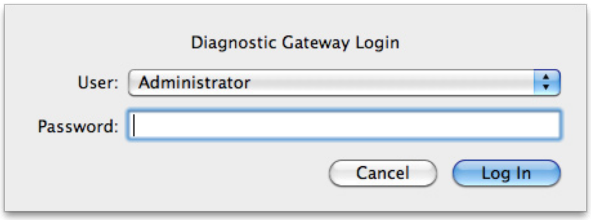
- The DG must be connected to a LAN that can reach the Internet.
- The DG must be properly configured to reach the Internet.
- Gateway Manager on the DG Mac must be properly configured with appropriate settings to reach and authenticate with Apple Diagnostic Repository.

Note: Gateway Manager and AST versions are tied together, so make sure you are using the latest version of each so they work properly together. If you are using multiple DGs, make sure all DGs on your LAN are using the latest version of AST. To update AST on one or more DG Macs, see Using Multiple Diagnostic Gateways with AST .

1. Gateway Manager is normally installed as part of AST software installation. If Gateway Manager is not installed, drag-copy it from the AST software disc image into /Applications.

2. Launch Gateway Manager on the DG Mac (located in /Applications).

3. Select 'Administrator' from the popup menu in the Gateway Login dialog, then enter the site-specific password for Gateway Manager. The default password is 'apple'. Administrators should change this password from the default as soon as possible.


Diagnostic Gateway Login

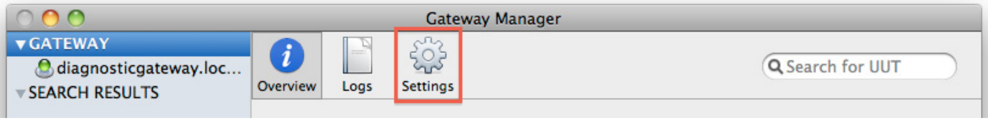
User: Administrator

Password:

Note: Administrator access allows you to configure additional logging parameters and settings, whereas Technician access does not. Both access levels allow you to examine UUT logs.

4. When the main Gateway Manager window appears, click on the Settings icon at the top of the window. You will see two sections with data entry fields appear in the lower section of the window titled General Information and Apple Diagnostic Repository.

Note: The Settings icon is only visible when logged in as Administrator. This icon is not visible when logged in as Technician.



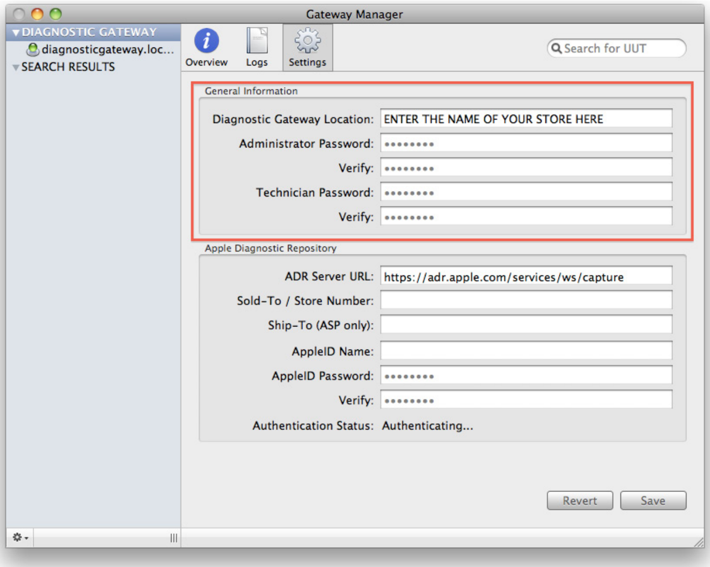
5. In the General Information section, you can change settings for the DG Mac you are using:

   * **Diagnostic Gateway Location:** The name used to identify the DG. Enter your store or site location here to uniquely identify your DG.

   * **Administrator Password:** This allows access to change settings in the Gateway Manager application as well as view UUT logs. The default password is 'apple'. Administrators should change this password as soon as possible to prevent accidental changes to these settings.

   * **Technician Password:** Allows access to examine UUT logs in the Gateway Manager only.

   ** Data is required in fields denoted with a bulleted asterisk.*



General Information

Diagnostic Gateway Location: ENTER THE NAME OF YOUR STORE HERE
Administrator Password: ••••••••
Verify: ••••••••
Technician Password: ••••••••
Verify: ••••••••

Apple Diagnostic Repository

ADR Server URL: https://adr.apple.com/services/ws/capture
Sold-To / Store Number:
Ship-To (ASP only):
AppleID Name:
AppleID Password: ••••••••
Verify: ••••••••
Authentication Status: Authenticating...

6. Fields in the Apple Diagnostic Repository section require the exact information below.

   Important: Failure to enter all the correct information may prevent the proper operation of the DG and AST.

   * **ADR Server URL:** This field should auto-populate with the Apple Diagnostic Repository (ADR) URL below. You only need to change this if have been instructed to do so.

   ADR URL: https://adr.apple.com/services/ws/capture

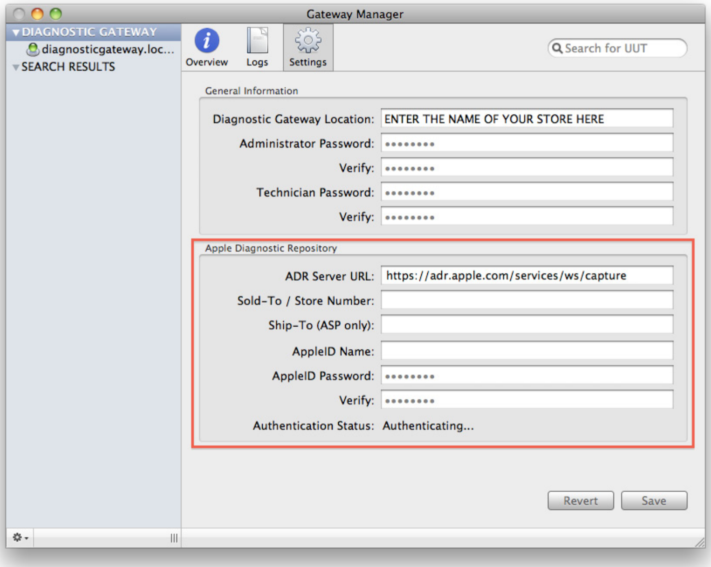
   * **Sold-To / Store Number:** Enter your GSX Sold-to account number (for AASPs and Depots), or Apple Retail Store number.

   * **Ship To (AASP only):** Enter your GSX Ship-to number. If you have only one ship-to location, this number may be the same as your sold-to number. Do not leave this field blank.

   * **Apple ID Name:** Enter the Apple ID of any GSX user assigned to this GSX sold-to / ship-to account (for AASPs), or the iTunes Apple ID (for Apple Retail Stores). **Note**: Please refer to the end of this section for instructions on validating your Apple ID.

   * **Apple ID Password:** Enter the password for the Apple ID entered above.

   ** Data is required in fields denoted with a bulleted asterisk.*



General Information

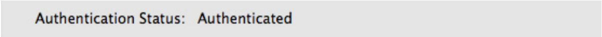
Diagnostic Gateway Location: ENTER THE NAME OF YOUR STORE HERE
Administrator Password: ••••••••
Verify: ••••••••
Technician Password: ••••••••
Verify: ••••••••

Apple Diagnostic Repository

ADR Server URL: https://adr.apple.com/services/ws/capture
Sold-To / Store Number:
Ship-To (ASP only):
AppleID Name:
AppleID Password: ••••••••
Verify: ••••••••
Authentication Status: Authenticating...

7. Click the Save button in the lower right corner of the window to save your settings. This will also verify that the account numbers, logins and passwords you entered have been authenticated by Apple. Look at the 'Authentication Status' message that appears just below the data entry fields. The authentication process may take several seconds.

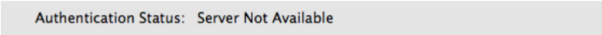
   If Apple Diagnostic Repository can be reached and the information validated, a status of "Authenticated" appears, as shown here:


Authentication Status: Authenticated

If Apple Diagnostic Repository can be reached and the information cannot be validated, a status of "Authentication Failed" appears, as shown here:

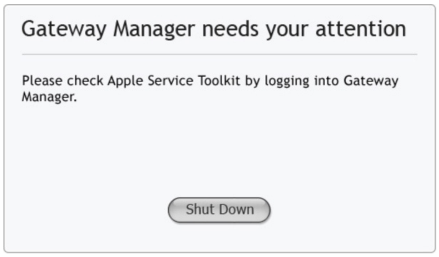
Authentication Status: Authentication Failed

If Apple Diagnostic Repository cannot be reached, a status of "Server Not Available" appears, as shown here:


Authentication Status: Server Not Available

Important: Proper operation of your DG relies on each of these settings being correct—so be careful when entering this information to ensure your DG authenticates to Apple Diagnostic Repository before attempting to use the DG for AST.

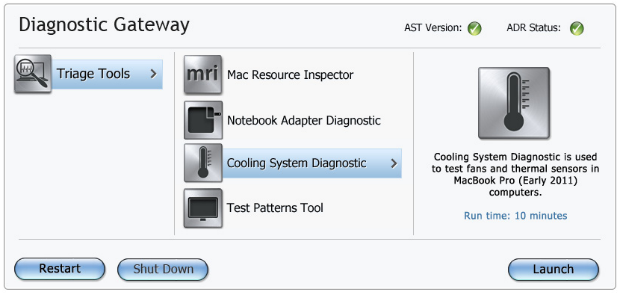
8. If Gateway Manager fails its first authentication attempt after initial setup, the following shutdown dialog will appear on the UUT, preventing you from using AST until you set up the DG properly.



Gateway Manager needs your attention

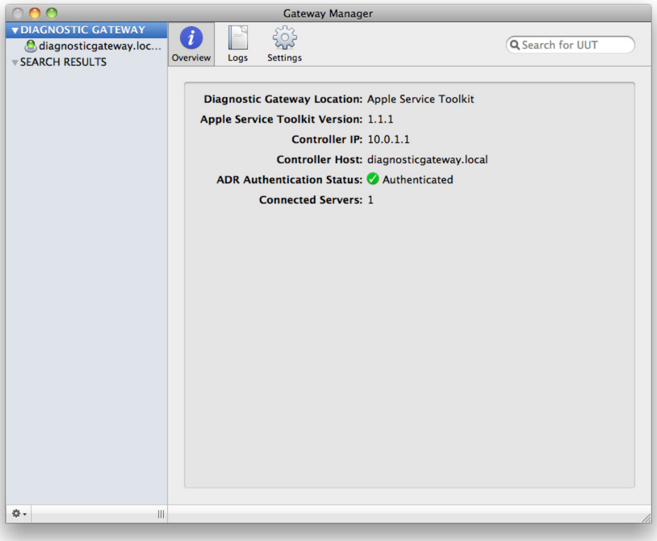
Please check Apple Service Toolkit by logging into Gateway Manager.

Diagnostic Gateway and Gateway Manager both show whether your network is connected to the Apple Diagnostic Repository (ADR), so that diagnostic test results from customers' computers are correctly reported to Apple.



Cooling System Diagnostic is used to test fans and thermal sensors in MacBook Pro (Early 2011) computers.

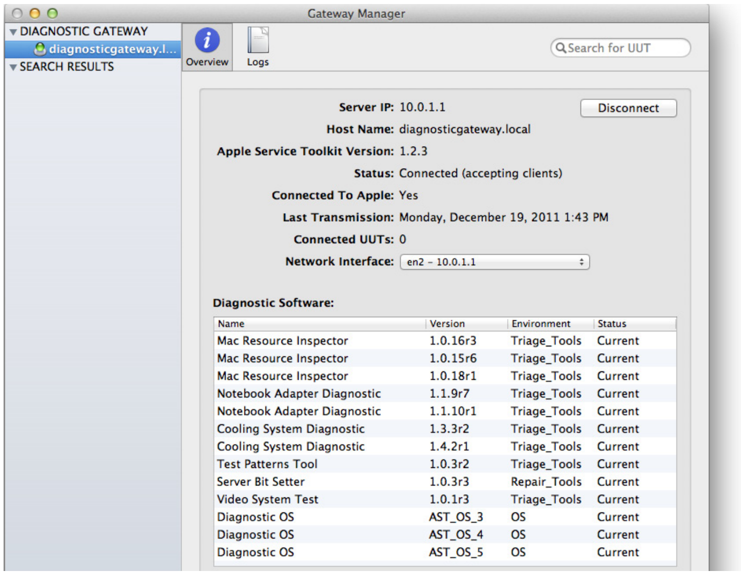
Run time: 10 minutes



Diagnostic Gateway Location: Apple Service Toolkit
Apple Service Toolkit Version: 1.1.1
Controller IP: 10.0.1.1
Controller Host: diagnosticgateway.local
ADR Authentication Status: ✓ Authenticated
Connected Servers: 1

Tip: You can also check Gateway Manager logs to verify DG authentication and to troubleshoot AST, DG, UUT and Internet connectivity. See the Gateway Manager Log Details section for information about using these logs to troubleshoot Gateway Manager issues.

If you are using AST on a DG Mac with multiple Ethernet ports, such as a Mac Pro or Xserve, you need to select which Ethernet port to use for AST services. This designates the Ethernet port from which AST diagnostics will be served. Make sure this is set for your UUT network.



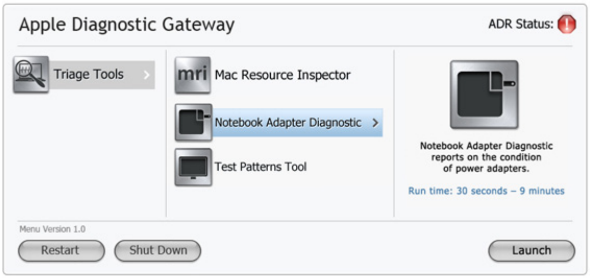
Server IP: 10.0.1.1
Host Name: diagnosticgateway.local
Apple Service Toolkit Version: 1.2.3
Status: Connected (accepting clients)
Connected To Apple: Yes
Last Transmission: Monday, December 19, 2011 1:43 PM
Connected UUTs: 0
Network Interface: en2 – 10.0.1.1

Diagnostic Software:

Name	Version	Environment	Status
Mac Resource Inspector	1.0.16r3	Triage_Tools	Current
Mac Resource Inspector	1.0.15r6	Triage_Tools	Current
Mac Resource Inspector	1.0.18r1	Triage_Tools	Current
Notebook Adapter Diagnostic	1.1.9r7	Triage_Tools	Current
Notebook Adapter Diagnostic	1.1.10r1	Triage_Tools	Current
Cooling System Diagnostic	1.3.3r2	Triage_Tools	Current
Cooling System Diagnostic	1.4.2r1	Triage_Tools	Current
Test Patterns Tool	1.0.3r2	Triage_Tools	Current
Server Bit Setter	1.0.3r3	Repair_Tools	Current
Video System Test	1.0.1r3	Triage_Tools	Current
Diagnostic OS	AST_OS_3	OS	Current
Diagnostic OS	AST_OS_4	OS	Current
Diagnostic OS	AST_OS_5	OS	Current

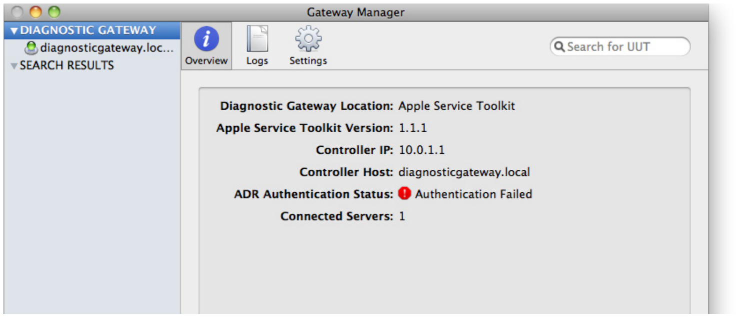
After initial authentication, AST should only require periodic re-authentication whenever the Apple ID password entered into Gateway Manager has changed.

If AST can no longer connect to the Apple Diagnostic Repository (ADR) (e.g., a network issue prevents contact), the DG is still usable. Logs are stored on the DG until contact is restored, and then they are transferred to the ADR. The DG launch screen and Gateway Manager window will show a red icon with an exclamation point to let you know that AST is not connected to the ADR.



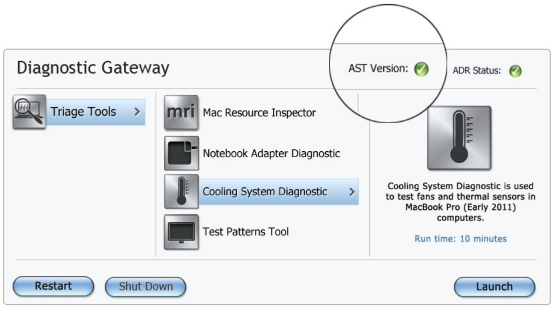
Notebook Adapter Diagnostic reports on the condition of power adapters.

Run time: 30 seconds – 9 minutes



Diagnostic Gateway Location: Apple Service Toolkit
Apple Service Toolkit Version: 1.1.1
Controller IP: 10.0.1.1
Controller Host: diagnosticgateway.local
ADR Authentication Status: ! Authentication Failed
Connected Servers: 1

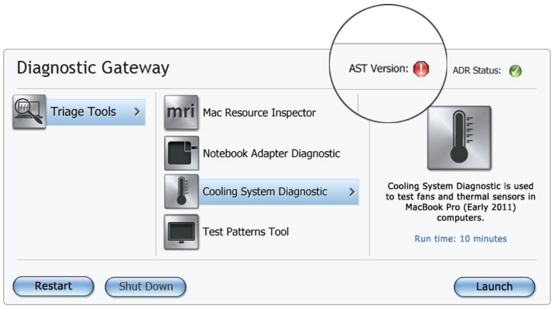
A green version validation icon appears in the menu when AST determines that all required components and their correct versions are installed.



Cooling System Diagnostic is used to test fans and thermal sensors in MacBook Pro (Early 2011) computers.

Run time: 10 minutes

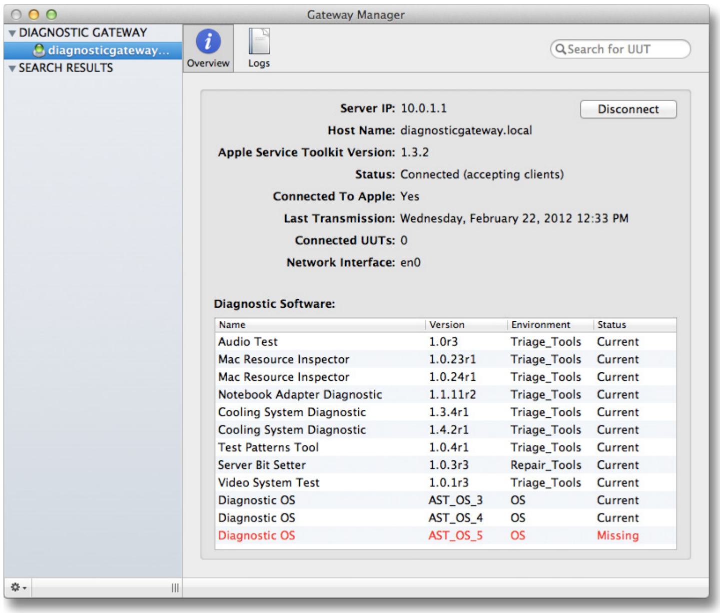
A red icon indicates a mismatch of older and newer AST software components.



Cooling System Diagnostic is used to test fans and thermal sensors in MacBook Pro (Early 2011) computers.

Run time: 10 minutes

Proper AST setup requires multiple installers. Go to Apple Support article [HT4595: Latest Apple Service Toolkit Download Links and Documentation]() to verify and download all AST components.

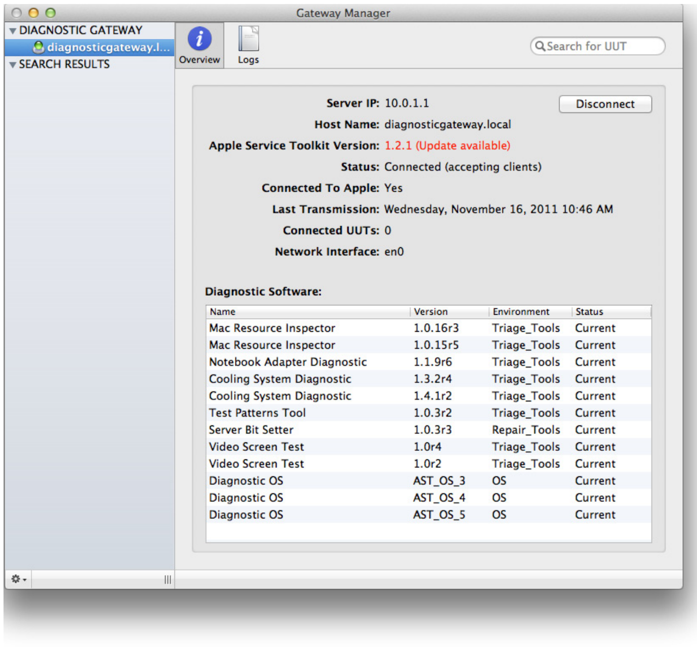


Server IP: 10.0.1.1
Host Name: diagnosticgateway.local
Apple Service Toolkit Version: 1.3.2
Status: Connected (accepting clients)
Connected To Apple: Yes
Last Transmission: Wednesday, February 22, 2012 12:33 PM
Connected UUTs: 0
Network Interface: en0

Diagnostic Software:

Name	Version	Environment	Status
Audio Test	1.0r3	Triage_Tools	Current
Mac Resource Inspector	1.0.23r1	Triage_Tools	Current
Mac Resource Inspector	1.0.24r1	Triage_Tools	Current
Notebook Adapter Diagnostic	1.1.11r2	Triage_Tools	Current
Cooling System Diagnostic	1.3.4r1	Triage_Tools	Current
Cooling System Diagnostic	1.4.2r1	Triage_Tools	Current
Test Patterns Tool	1.0.4r1	Triage_Tools	Current
Server Bit Setter	1.0.3r3	Repair_Tools	Current
Video System Test	1.0.1r3	Triage_Tools	Current
Diagnostic OS	AST_OS_3	OS	Current
Diagnostic OS	AST_OS_4	OS	Current
Diagnostic OS	AST_OS_5	OS	Missing

Gateway Manager performs an overall software version check to make sure you are running the newest version of AST. If not, it will display a red warning showing that an update is available.



Server IP: 10.0.1.1
Host Name: diagnosticgateway.local
Apple Service Toolkit Version: 1.2.1 (Update available)
Status: Connected (accepting clients)
Connected To Apple: Yes
Last Transmission: Wednesday, November 16, 2011 10:46 AM
Connected UUTs: 0
Network Interface: en0

Diagnostic Software:

Name	Version	Environment	Status
Mac Resource Inspector	1.0.16r3	Triage_Tools	Current
Mac Resource Inspector	1.0.15r5	Triage_Tools	Current
Notebook Adapter Diagnostic	1.1.9r6	Triage_Tools	Current
Cooling System Diagnostic	1.3.2r4	Triage_Tools	Current
Cooling System Diagnostic	1.4.1r2	Triage_Tools	Current
Test Patterns Tool	1.0.3r2	Triage_Tools	Current
Server Bit Setter	1.0.3r3	Repair_Tools	Current
Video Screen Test	1.0r4	Triage_Tools	Current
Video Screen Test	1.0r2	Triage_Tools	Current
Diagnostic OS	AST_OS_3	OS	Current
Diagnostic OS	AST_OS_4	OS	Current
Diagnostic OS	AST_OS_5	OS	Current

Apple ID Validation

If you are having difficulties authenticating your DG Mac to Apple's Diagnostic Repository, the issue may lie with your Apple ID and/or password, which may have expired. Here are some tips for validating your Apple ID and password, which may resolve your authentication issue.

The Apple ID you use in Gateway Manager should be the one you normally use to log into GSX (https://gsx2.apple.com).

Please remember that GSX security policies may dictate that your Apple ID password must be changed periodically (for example, every 90 days). If you change the Apple ID password you use to log into GSX, then you will also need to update your Apple ID password in Gateway Manager to match, because it uses the same Apple ID and password.

If you fail to update your Apple ID password in response to such security policies, your Apple ID may become disabled for security reasons until you validate it again by updating your password.

If there is any issue with your Apple ID and/or its password, Gateway Manager may repeatedly display a status of "Authentication Failed" even though you have verified that all data seems to be entered into Gateway Manager properly.

Try the following steps to validate your Apple ID. Once validated and updated, your Apple ID and password should work properly in Gateway Manager to authenticate your DG Mac to ADR.

Step 1

- Check the 'AST_Repository.log' file (which can be found in Gateway Manager logs function, or by navigating to /var/log/adg). In many cases the log will indicate that the name and/or password is incorrect and is being rejected.

Step 2

- Go to the My Apple ID portal site http://appleid.apple.com. Click the link on the right side for "manage your account."

Step 3

- You will be prompted to sign in. Enter the Apple ID and password currently used for Gateway Manager/AST.
- In many cases the site will indicate that the password has expired. Follow the prompt to reset the password. **Note**: Apple ID passwords are typically set to expire every 90 days.

Step 4

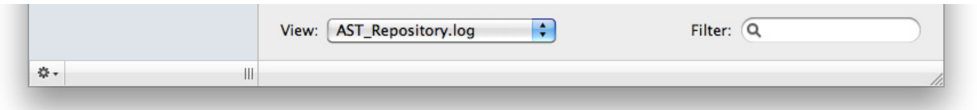
- Enter the new password for your Apple ID into the Gateway Manager settings.
- Allow up to 3 minutes for AST to cycle its connection to Apple's Diagnostic Repository and authenticate.

If the above steps fail to resolve your authentication issue, please contact AST_support@apple.com for further assistance.

Gateway Manager Logs Details

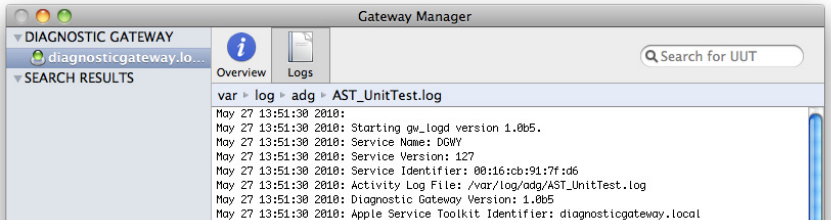
The DG Mac creates, uses and manages three log files that can be used to troubleshoot Gateway Manager behavior. The information contained in these logs is described here.

Click on the name of the DG from the left pane, then select the log you wish to view from the popup menu at the bottom of the Gateway Manager window, as shown here:



AST_UnitTest.log

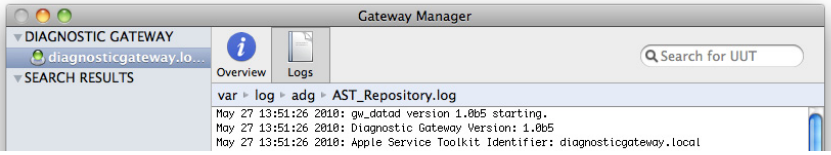
This log file contains information about UUTs that are connecting and disconnecting from the DG. Failed UUT check results are also logged here.



```
May 27 13:51:30 2010:
May 27 13:51:30 2010: Starting gw_logd version 1.0b5.
May 27 13:51:30 2010: Service Name: DGWY
May 27 13:51:30 2010: Service Version: 127
May 27 13:51:30 2010: Service Identifier: 00:16:cb:91:7f:d6
May 27 13:51:30 2010: Activity Log File: /var/log/adg/AST_UnitTest.log
May 27 13:51:30 2010: Diagnostic Gateway Version: 1.0b5
May 27 13:51:30 2010: Apple Service Toolkit Identifier: diagnosticgateway.local
```

AST_Repository.log

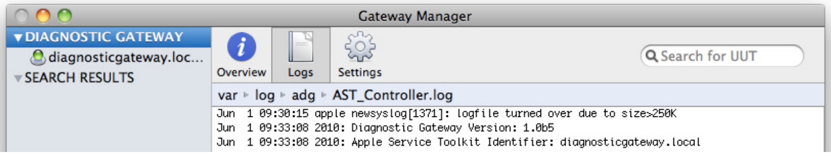
This log file contains information about communication between the DG and Apple Diagnostic Repository.



```
May 27 13:51:26 2010: gw_datad version 1.0b5 starting.
May 27 13:51:26 2010: Diagnostic Gateway Version: 1.0b5
May 27 13:51:26 2010: Apple Service Toolkit Identifier: diagnosticgateway.local
```

AST_Controller.log

This log file contains information about communication between UUTs and the DG.



```
Jun  1 09:30:15 apple newsyslog[1371]: logfile turned over due to size>250K
Jun  1 09:33:08 2010: Diagnostic Gateway Version: 1.0b5
Jun  1 09:33:08 2010: Apple Service Toolkit Identifier: diagnosticgateway.local
```

Using Multiple AST Servers with AST

A single AST server acting as the Diagnostic Gateway can handle a substantial UUT load and should be adequate for most situations. AST has been tested to support over 60 UUTs simultaneously NetBooted from a single Mac mini. However, if your site requires more capacity, consider installing and configuring multiple AST servers on the same LAN.

As multiple AST servers on the same LAN communicate with each other over the network, one server will automatically select itself as the Gateway Controller, managing all the other servers.

Any Mac can access logs from any AST server on that LAN. You do not need to know which AST server collected a specific UUT's log to view its test results in Gateway Manager. All UUT test results across all servers on the same LAN will appear in Gateway Manager.

Gateway Controller Behavior

Multiple AST servers on the same LAN work together as a single entity called the Diagnostic Gateway. In this scenario, the Diagnostic Gateway refers to the collection of AST servers all running the Gateway daemons on the same LAN subnet. The Gateway Controller is the master server that communicates and coordinates with the other servers and Gateway Manager.

In a multi-server setup, the Gateway Controller is typically the first AST server that comes online. If this server becomes unavailable for any reason, its "Controller" status is automatically transferred to one of the other servers.

For example, consider the following scenario:

- You set up Server A and install AST. The Gateway daemons launch, and it becomes the Gateway Controller for the DG on that LAN.
- Then, you set up Server B on the same LAN and install AST. The Gateway daemons launch, and it becomes just another server on the same DG as Server A.
- Later, you "Disconnect" Server A to perform a software update. Server B then becomes the Gateway Controller for the DG on that LAN.
- After the Software Update, Server A can be re-connected to allow it to resume accepting any new connections from UUTs. Server A becomes part of the DG collection again. Server B remains as the Gateway Controller for the DG on that LAN.

In a single-server setup, the server is both the Diagnostic Gateway and the Gateway Controller.

Managing a Multiple-Server Diagnostic Gateway

The AST server that has been designated as the Gateway Controller monitors and reports the status of all servers that have ever been a part of its DG collection. All servers in the DG collection are listed in the left pane of the Gateway Manager window.

This is the best place to check multiple server functionality. If an individual server becomes unavailable or needs to be checked, its icon turns red in this list. Use the 'Remove Server' command in Gateway Manager to remove an unresponsive server from the list.

Note: Consult Gateway Manager Help in the Gateway Manager application for more information.

Updating AST Software

If you have an AST Diagnostic Gateway Mac (DG Mac) already set up, follow these steps to update to the latest version of AST.

1. If running OS X Lion Server, skip to the next step. If running OS X Server 10.6, enable Network File System (NFS) service, if it is not already enabled on your server.
2. Download the current AST disc image to your DG Mac from Apple Support article HT4595: Latest Apple Service Toolkit Download Links and Documentation.
3. Open the AST disc image and launch the installation package file.
4. Download all sets of AST OS image components from HT4595: Latest Apple Service Toolkit Download Links and Documentation to your DG Mac. The full collection of AST diagnostics requires each of these operating system images to operate from within AST.
5. Assemble each set of AST OS components by double-clicking on the .001 component.
6. Open the resulting AST OS installer package. Your AST server is updated when the operating system installer finishes.

Updating AST on Servers in a DG Collection

If you ever need to update the AST software on any of the servers in a DG collection, you should perform the following steps on each AST server in the DG collection before performing the update. These steps will ensure that all servers in the DG collection have stopped accepting UUT logs—a required step before updating the AST software:

1. In the left pane of Gateway Manager, select the name of the first server you wish to update.
2. Select 'Disconnect' from the action (gear) menu in the lower left corner of the window. This prompts the server to stop accepting logs from UUTs.
3. Observe the left pane. The server name will display the number of UUTs connected. Wait for this number to drop to zero as the UUTs finish sending logs to that server.
4. You can now safely update your AST software on that server by running the installer. This will also install the latest version of Gateway Manager. You can download the latest version of AST from HT4595: Latest Apple Service Toolkit Download Links and Documentation.
5. Repeat steps 1 through 4 above for all AST servers installed on the same LAN.
6. If you are using Gateway Manager on any Macs on the LAN in addition to your DG Mac(s), be sure to copy the Gateway Manager application to those computers so that all Macs are using the latest version. Gateway Manager is available from the AST software disc image and should be copied into the /Applications folder.

DHCP Server Configuration

This section provides instructions for configuring DHCP services on a dedicated DG Mac. These instructions should **only** be used when your existing LAN does not already have a DHCP server.

1. In Server Admin, configure DHCP services by selecting the DHCP Service in the left pane of the Server Admin window (you may need to open the disclosure triangle).

2. Click the 'Subnets' icon in the Server Admin toolbar to display DHCP settings.

3. If there is an existing subnet already displayed, select it and click the - (minus) button to delete it. **Be sure that the DHCP entry you create below is the only defined subnet.**

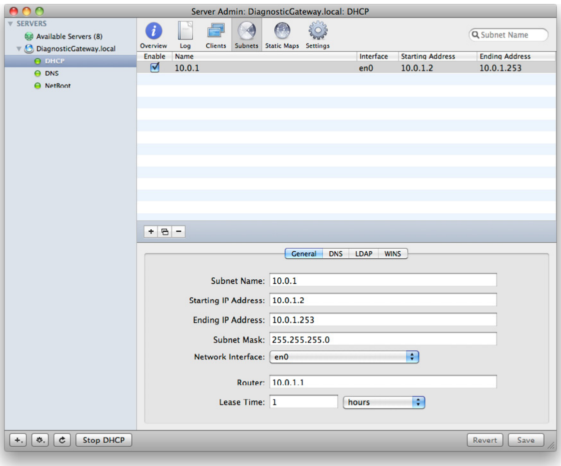
4. Click the + (plus) button to create a new subnet entry.

5. In the IP address field at the bottom of the window, configure this subnet's DHCP settings as follows, using the supplied defaults:
   - Subnet Name: 10.0.1
   - Starting IP Address: 10.0.1.2
   - Ending IP Address: 10.0.1.253
   - Subnet Mask: 255.255.255.0
   - Network Interface: Whichever network interface connects to the UUT network. This may be the built-in Ethernet port (en0), or it may be the second wired Ethernet interface (en1 or en2, depending on whether the DG Mac has AirPort or not).

     Caution: To avoid connectivity issues, only activate DHCP services on a network that does not have DHCP enabled. Do not activate DHCP services on a network with an existing DHCP server.
   - Router: 10.0.1.1 (this Mac itself)
   - Lease Time: 1 hour

6. Enable this subnet by selecting the entry and clicking the 'Enable' checkbox.

7. Click Save to save your settings, then click 'Start DHCP' to enable DHCP services.

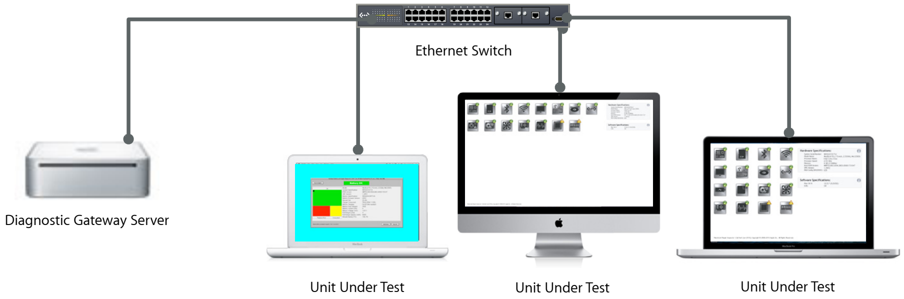


Server Admin: DiagnosticGateway.local: DHCP

Enable	Name	Interface	Starting Address	Ending Address
☑	10.0.1	en0	10.0.1.2	10.0.1.253

Subnet Name: 10.0.1
Starting IP Address: 10.0.1.2
Ending IP Address: 10.0.1.253
Subnet Mask: 255.255.255.0
Network Interface: en0
Router: 10.0.1.1
Lease Time: 1 hours

Using AST



MRI or NAD does not require installation on the UUT. Instead, it is served over NetBoot from the DG Mac and loaded onto the UUT when it starts up.

1. Connect the UUT Mac via Ethernet cable to the same LAN as the DG.

   Important Tip for Desktop UUTs: On UUTs that have two Ethernet ports, such as Mac Pros, use the left Ethernet connector: "1" not "2." This corresponds to 'en0.'

2. If checking a portable UUT, connect the correct power adapter before proceeding. For a desktop UUT, connect a known-good, wired Apple USB keyboard and known-good wired Apple USB mouse to any available USB ports on the UUT.

   NOTE: Do not use a 3rd-party USB keyboard or mouse with AST. Third-party devices may require drivers that would be unavailable in the EFI environment and may cause AST to hang.

3. Start up the UUT while holding down the N key, prompting it to start up from the DG over NetBoot. If the UUT can display an image, the familiar flashing globe will appear on the primary display, indicating that the UUT is searching for a NetBoot server.

Tip: You can also press the Option (Alt) key during startup to boot into Startup Manager. Once in Startup Manager, press N to make the first NetBoot volume appear. NetBooting the UUT this way allows you to verify availability of a NetBoot server or other startup volume before continuing the startup process.

Refer to the following Apple Support articles for more information:

- HT1533: Startup key combinations for Intel-based Macs
- HT1310: Startup Manager: How to select a startup volume

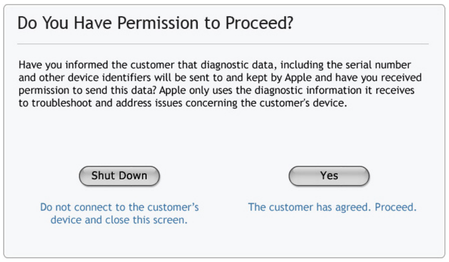
Troubleshooting Tip for Desktop UUTs: Use a known-good Apple USB keyboard with all its firmware updates installed. Otherwise the UUT may not recognize the N key being held down and will fail to NetBoot.

- Try a different known-good Apple USB keyboard. Remember that some newer Apple USB keyboards may not function with some older Macs.
- Try a different USB port on the UUT in case the first USB port is malfunctioning.

- Make sure a firmware password is not set on the UUT, which would prevent NetBooting.

Note: AST will always select and use the internal display if it can detect its presence (i.e., if connected), even if an external display is also connected. If AST cannot detect the presence of an internal display and an external display is also connected, then AST will use the external display instead as its primary (and only supported) display.

4. If the DG Mac is configured and operational, and the UUT can reach the DG over the LAN, the UUT Mac should start up to the Informed Consent dialog within several seconds. This initial screen, shown below, verifies that you have obtained your customer's permission to proceed running the diagnostic on his or her Mac.



Do You Have Permission to Proceed?

Have you informed the customer that diagnostic data, including the serial number and other device identifiers will be sent to and kept by Apple and have you received permission to send this data? Apple only uses the diagnostic information it receives to troubleshoot and address issues concerning the customer's device.

Do not connect to the customer's device and close this screen.

The customer has agreed. Proceed.

5. Only proceed if the customer has given you his/her permission to do so. Explain that only hardware diagnostic data and computer serial number are collected. No personal information is collected at all.

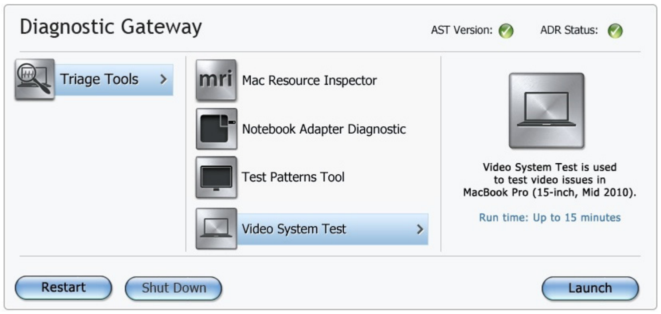
   Note: Refer to the section titled UUT Information Collected and Sent to Apple for complete information about what is collected and sent to Apple Diagnostic Repository.

6. If you select Yes (or type Y on the keyboard), AST will proceed to the menu in step 8 below.

7. If you select Shut Down (or type S on the keyboard), AST will shut down the UUT so you can disconnect the Ethernet cable. In this case, follow other troubleshooting procedures such as those found in the Apple Technician Guide and Apple Support website for that product.

   Note: In case the UUT has no video, you must use the Y or S keys to advance past this dialog. AST will not proceed automatically.

8. When you answer Yes to the Informed Consent, the Diagnostic Gateway menu appears, allowing you to select which diagnostic to run.



Video System Test is used to test video issues in MacBook Pro (15-inch, Mid 2010).

Run time: Up to 15 minutes

You will always see a complete list of whatever diagnostics are appropriate for that UUT. For instance, you won't see Notebook Adapter Diagnostic when you run AST on desktop Macs.

As AST is further refined and developed, new diagnostics may appear in future versions.

9. Select the desired diagnostic from the menu (you can use arrow keys to move the selection), and click 'Launch' (or press Return on the keyboard) to continue. The selected diagnostic launches and runs on the UUT Mac.

   Important: If nothing is selected from the menu within 15 seconds, AST launches MRI automatically to help diagnose UUTs with "no video" issues.

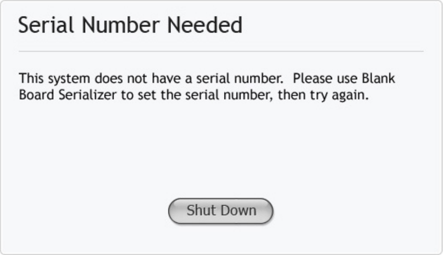
10. The display may briefly turn black, flashing text in the upper-left corner for a few seconds. This is normal behavior. MRI should launch after a few more seconds, and the display should change to white.

11. Always shut down the UUT properly—using either the "Shut Down" button on-screen or the "S" key on the keyboard—after diagnostics have been launched and run from the AST menu.

    Important: Do not hold down the power button to shut down the UUT after AST diagnostics finish. Shutting down the UUT improperly can cause NVRAM corruption that interferes with some AST diagnostic testing sequences.

Using MRI

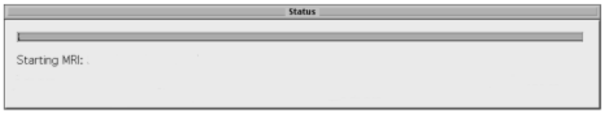
1. Upon launch on a UUT Mac, MRI verifies that a valid system serial number is stored in firmware on the logic board. If it doesn't find one, you will see the following dialog.



Serial Number Needed

This system does not have a serial number. Please use Blank Board Serializer to set the serial number, then try again.

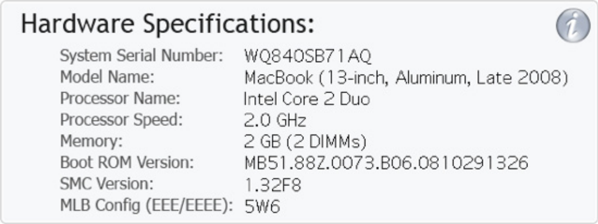
2. Next, MRI attempts to gather information about the UUT; then it creates and sends a log file over the network to the DG for storage. It displays a progress bar and status message to let you know what's happening during its initial loading and information gathering stage.



Starting MRI:

NOTE: If the UUT hangs when starting MRI, check that you are using only a known-good, wired Apple USB keyboard and known-good wired Apple USB mouse with the UUT. Do not use a 3rd-party USB keyboard or mouse with AST. Third-party devices may require drivers that would be unavailable in the EFI environment and may cause AST to hang.

3. Once MRI is loaded, it displays the UUT's hardware information in the Hardware Specifications overview area in the upper right.

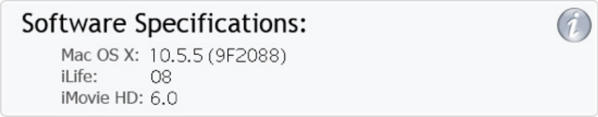


Hardware Specifications:

System Serial Number: WQ840SB71AQ
Model Name: MacBook (13-inch, Aluminum, Late 2008)
Processor Name: Intel Core 2 Duo
Processor Speed: 2.0 GHz
Memory: 2 GB (2 DIMMs)
Boot ROM Version: MB51.88Z.0073.B06.0810291326
SMC Version: 1.32F8
MLB Config (EEE/EEEE): 5W6

Refer to the UUT Hardware Specifications section for further details.

4. When the hardware information has been gathered, MRI gathers software information in the Software Specifications overview area on the right. This describes the version of OS X and iLife components that are installed on all volumes with Mac OS.

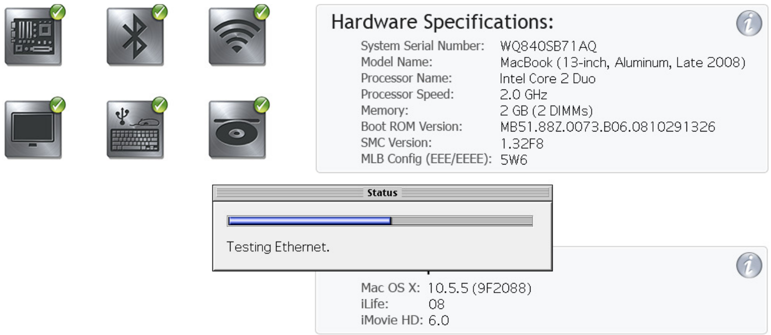


Software Specifications:

Mac OS X: 10.5.5 (9F2088)
iLife: 08
iMovie HD: 6.0

Refer to the UUT Software Specifications section for further details.

5. MRI runs its checks. As each module is verified, MRI adds an icon representing that module to the main screen. A progress indicator displays details about each item being checked.



Hardware Specifications:
System Serial Number: WQ840SB71AQ
Model Name: MacBook (13-inch, Aluminum, Late 2008)
Processor Name: Intel Core 2 Duo
Processor Speed: 2.0 GHz
Memory: 2 GB (2 DIMMs)
Boot ROM Version: MB51.88Z.0073.B06.0810291326
SMC Version: 1.32F8
MLB Config (EEE/EEEE): 5W6

Testing Ethernet.

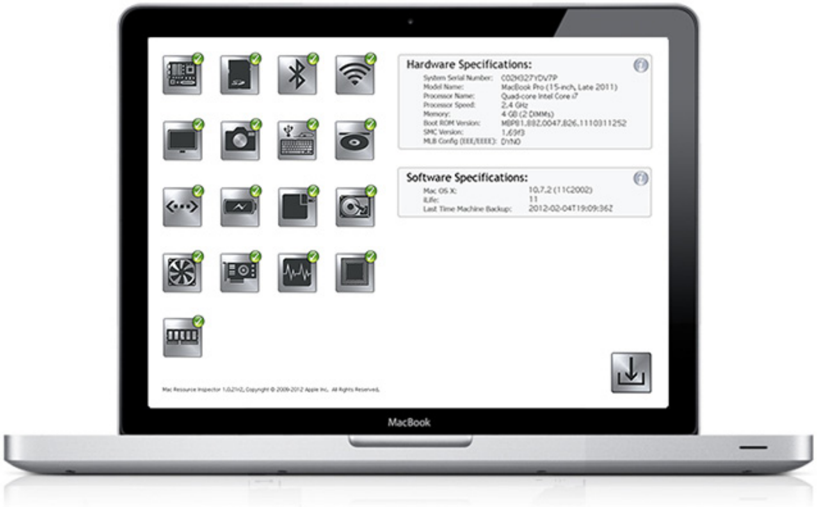
Mac OS X: 10.5.5 (9F2088)
iLife: 08
iMovie HD: 6.0

6. When MRI has finished checking and testing, press S to shut down the UUT. The UUT can then be disconnected from the LAN by disconnecting the Ethernet cable from the UUT.

   Important: Do not disconnect the UUT from the LAN until testing is complete. This ensures that all DG operations, such as test activity logging, are able to finish.

7. Once MRI completes the check process, you can interact with icons on the MRI screen using the UUT's keyboard and mouse/trackpad. Test results are only sent once, during initial MRI checking and testing. No further logging is performed after MRI finishes.

8. MRI displays color-coded badges on each hardware icon to indicate its status (pass, fail, caution), as shown in the MacBook example below. For more details on what these badges mean, see the section titled Interpreting MRI Results.



Hardware Specifications:
System Serial Number: C02H327YDV7P
Model Name: MacBook Pro (15-inch, Late 2011)
Processor Name: Quad-core Intel Core i7
Processor Speed: 2.4 GHz
Memory: 4 GB (2 DIMMs)
Boot ROM Version: MBP81.88Z.0047.B26.1110311252
SMC Version: 1.69f3
MLB Config (EEE/EEEE): DYNO

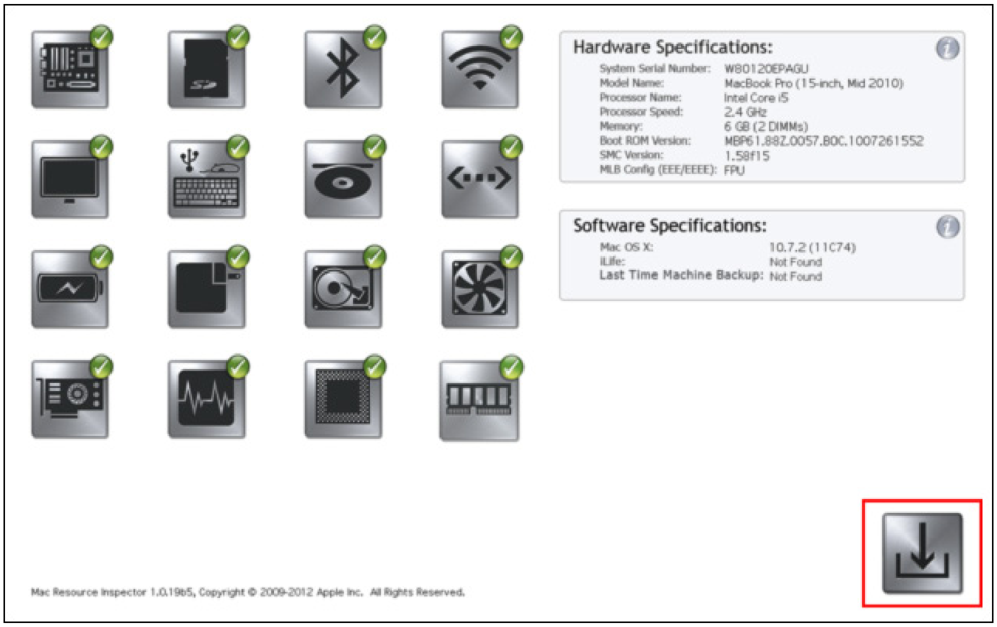
Software Specifications:
Mac OS X: 10.7.2 (11C2002)
iLife: 11
Last Time Machine Backup: 2012-02-04T19:09:36Z

9. Clicking an icon, or the 'i' symbol in the hardware or software specifications area, displays a configuration window with more information about that module. This configuration window contains a "result" line (the first line), an optional "issue" line, a small version of the module icon, and any additional information about the module (such as hard drive size).

   Note: You can also navigate using keyboard keys. See AST Keyboard Operation for details.

NEW!

10. On the bottom right of the MRI results screen is the NVRAM / SMC reset button, which clears the NVRAM and resets the SMC with one click, saving time during troubleshooting.



Hardware Specifications:

System Serial Number: W80120EPAGU
Model Name: MacBook Pro (15-inch, Mid 2010)
Processor Name: Intel Core i5
Processor Speed: 2.4 GHz
Memory: 6 GB (2 DIMMs)
Boot ROM Version: MBP61.88Z.0057.B0C.1007261552
SMC Version: 1.58f15
MLB Config (EEE/EEEE): FPU

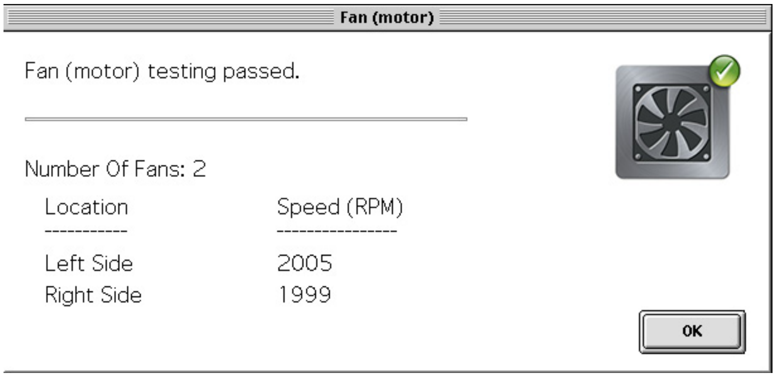
Software Specifications:

Mac OS X: 10.7.2 (11C74)
iLife: Not Found
Last Time Machine Backup: Not Found

Mac Resource Inspector 1.0.19b5, Copyright © 2009-2012 Apple Inc. All Rights Reserved.

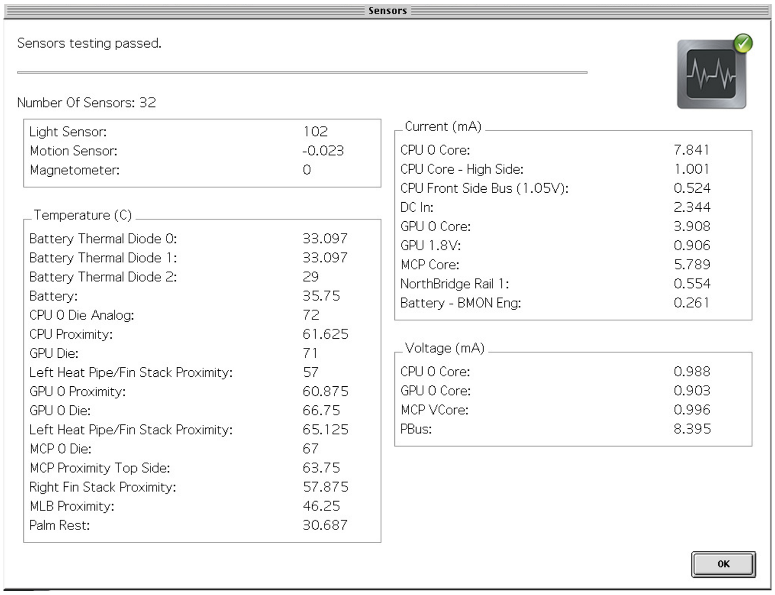
11. Some modules, such as Battery, Adapter, and Fan, have "live" results. When any of these module windows are open (the window values update every second), the tech can change a setting and watch MRI (based on the Mac's hardware) reveal that change live. For example, the power adapter can be connected or disconnected when running MRI on a portable, and MRI's power adapter status display will be updated to show this.

The example below shows the fan motor check result window:



```
Fan (motor) testing passed.

Number Of Fans: 2
   Location            Speed (RPM)
   ------------        -----------------
   Left Side           2005
   Right Side          1999
```

12. MRI's sensor check also shows live data for all internal sensors while the results window is open. Any missing, disconnected, or out-of-range sensor readings are flagged as red.



Sensors testing passed.

Number Of Sensors: 32

Light Sensor:	102
Motion Sensor:	-0.023
Magnetometer:	0

Temperature (C)

Battery Thermal Diode 0:	33.097
Battery Thermal Diode 1:	33.097
Battery Thermal Diode 2:	29
Battery:	35.75
CPU 0 Die Analog:	72
CPU Proximity:	61.625
GPU Die:	71
Left Heat Pipe/Fin Stack Proximity:	57
GPU 0 Proximity:	60.875
GPU 0 Die:	66.75
Left Heat Pipe/Fin Stack Proximity:	65.125
MCP 0 Die:	67
MCP Proximity Top Side:	63.75
Right Fin Stack Proximity:	57.875
MLB Proximity:	46.25
Palm Rest:	30.687

Current (mA)

CPU 0 Core:	7.841
CPU Core - High Side:	1.001
CPU Front Side Bus (1.05V):	0.524
DC In:	2.344
GPU 0 Core:	3.908
GPU 1.8V:	0.906
MCP Core:	5.789
NorthBridge Rail 1:	0.554
Battery - BMON Eng:	0.261

Voltage (mA)

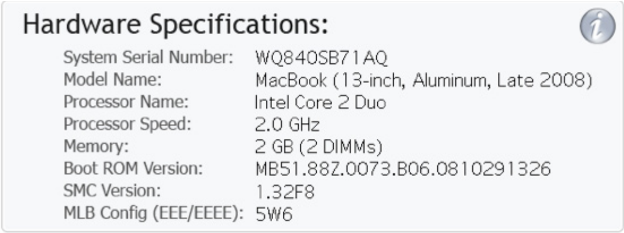
CPU 0 Core:	0.988
GPU 0 Core:	0.903
MCP VCore:	0.996
PBus:	8.395

Troubleshooting tip: If MRI reports a temperature sensor or fan as failing, do not leave the system running. Shut it down as soon as possible because excessive temperature may damage internal components. Check that the affected sensor(s) or fan(s) are correctly connected and that the fan(s), heatsink fin stack, and internal air flow are each free from dust or obstructions before retesting the system again.

UUT Hardware Specifications

MRI gathers UUT hardware configuration information in the Hardware Specifications overview in the upper right of the screen, listing UUT hardware configuration parameters such as the system serial number, AppleCare name, processor name and speed, installed memory, and so on.

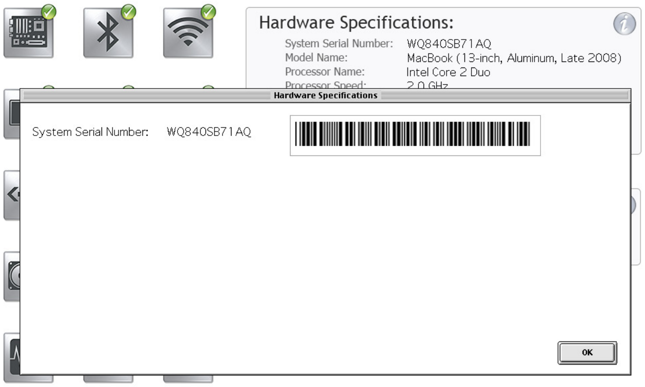
Supported hardware: All Macs.



Hardware Specifications:

System Serial Number: WQ840SB71AQ
Model Name: MacBook (13-inch, Aluminum, Late 2008)
Processor Name: Intel Core 2 Duo
Processor Speed: 2.0 GHz
Memory: 2 GB (2 DIMMs)
Boot ROM Version: MB51.88Z.0073.B06.0810291326
SMC Version: 1.32F8
MLB Config (EEE/EEEE): 5W6

Click on the ‘i’ symbol in the Hardware Specifications overview to display a configuration window with a scannable bar code of the UUT system serial number as shown here.



Hardware Specifications:

System Serial Number: WQ840SB71AQ
Model Name: MacBook (13-inch, Aluminum, Late 2008)
Processor Name: Intel Core 2 Duo

Hardware Specifications

System Serial Number: WQ840SB71AQ

MRI Log Examples – Hardware Specifications

```
DATA Logic Board MLB AppleCare Name MacBook (13-inch, Aluminum, Late 2008)

DATA Logic Board MLB MLB Config 5W6

DATA Logic Board MLB System Serial Number WQ840SB71AQ

DATA Logic Board MLB Boot ROM Version MB51.88Z.0073.B06.0810291326

DATA Logic Board MLB SMC Version 1.32F8

DATA Logic Board MLB Macintosh Model MacBook5,1

DATA Logic Board MLB Macintosh Board-ID Mac-F2268EA9

DATA Logic Board MLB Processor Vendor GenuineIntel

DATA Logic Board MLB Processor Model Intel Core 2 Duo

DATA Logic Board MLB Speed 2.0GHz
```

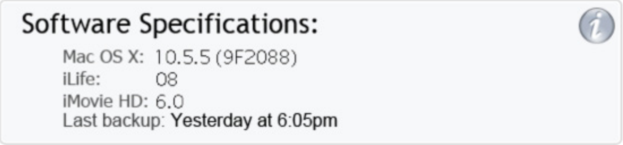
UUT Software Specifications

MRI gathers software information about the UUT and displays it in the Software Specifications overview to the right.

- It reports incorrect versions and builds of OS X, allowing you to identify downgraded operating systems and restore system software to its proper configuration.
- It identifies which iLife components are installed.

NEW!

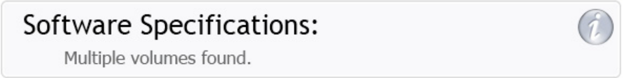
- It shows you when Time Machine was last used to back up the computer.



Software Specifications:

Mac OS X: 10.5.5 (9F2088)
iLife: 08
iMovie HD: 6.0
Last backup: **Yesterday at 6:05pm**

Software Specifications overview for a single volume, including Time Machine backup.

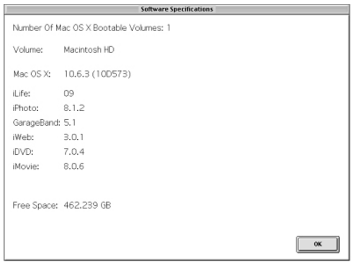


Software Specifications:

Multiple volumes found.

Software Specifications overview when multiple volumes are found.

Click on the 'i' symbol to display a configuration window with information about OS X and iLife.



Number Of Mac OS X Bootable Volumes: 1

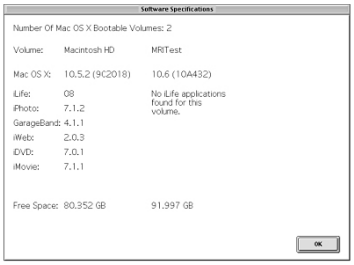
Volume: Macintosh HD

Mac OS X: 10.6.3 (10D573)

iLife: 09
iPhoto: 8.1.2
GarageBand: 5.1
iWeb: 3.0.1
iDVD: 7.0.4
iMovie: 8.0.6

Free Space: 462.239 GB

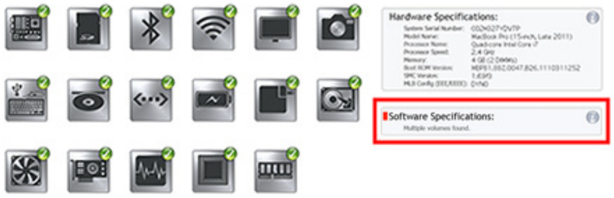
Volume info window for one volume and no iMovie HD



Number Of Mac OS X Bootable Volumes: 2

Volume:	Macintosh HD	MRITest
Mac OS X:	10.5.2 (9C2018)	10.6 (10A432)
iLife:	08	No iLife applications found for this volume.
iPhoto:	7.1.2	
GarageBand:	4.1.1	
iWeb:	2.0.3	
iDVD:	7.0.1	
iMovie:	7.1.1	
Free Space:	80.352 GB	91.997 GB

Volume info window for two volumes, the second with no iLife installed



MRI identifies incorrect OS X installations on units under test.

Notes:

- MRI relies on the iPhoto version to determine the iLife version; if iPhoto doesn't exist, MRI will not attempt to find other iLife applications.
- MRI will not list volumes with no Mac OS or other operating system (i.e., Linux or Windows).
- MRI only finds applications located in that volume's Applications folder.
- Volume names are not output to the log to ensure the customer's privacy.

MRI Log Examples - Software Specifications

```
SOFTWARE||||Number Of Mac OS X Bootable Volumes|Unit_Int|1|

SOFTWARE||6|Volume Size|Unit_User|2 (TB)|Unit_MB|2000054|Unit_GB|2000|Unit_TB|2|

SOFTWARE||6|Volume Free Space|Unit_User|1 (TB)|Unit_MB|1984432|Unit_GB|1984|Unit_TB|1|

SOFTWARE|6|Volume Free Space Percentage|Unit_Percentage|92|Unit_String|Desired|
```

From Snow Leopard:

“Danger” if # MB < 125 or free space percentage <= 5

“Warning” if # MB < 250 or free space percentage <= 10

“Desired” if not warning or danger

```
DATA||6||Mac OS X Version|Unit_String|10.6.2 (10C2229)|Unit_String|10.6.2|Unit_String|10C2229|Unit_String|non-server|
```

Supporting data: none

Field #5 (“10.6.2 ”) Build version

Field #7 (“10C540”) Build number

Field #9 (“on-server”) “non-server” or “server”

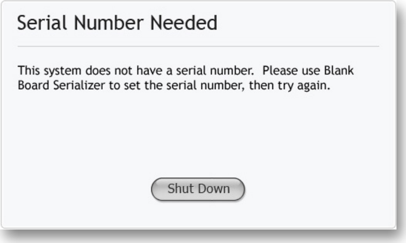
```
DATA|SOFTWARE|0||iPhoto Version|Unit_String|8.1.1|

DATA|SOFTWARE|0||iMovie Version|Unit_String|8.0.5|

DATA|SOFTWARE|0||iMovie HD Version|Unit_String|6.0.1|

DATA|SOFTWARE|0||GarageBand Version|Unit_String|5.1

SOFTWARE||6||iWeb Version|Unit_String|3.0.1|

SOFTWARE||6||iDVD Version|Unit_String|7.0.4|
```

Using Notebook Adapter Diagnostic (NAD)

NAD provides a much more thorough check of power adapter functionality than simply connecting the adapter to the computer and watching for a green or amber light. It checks the actual DC current coming into the UUT from the power adapter. It also monitors the battery's voltage as it controls current to the power adapter during the test.

It first turns off the power adapter's current via software control. Then it waits a short amount of time to verify that the battery's voltage drops by a certain amount. Then it turns on the power adapter's current via software control and verifies that the battery's voltage rises by a certain amount in a certain period of time, indicating that the adapter is providing proper charging current and therefore functioning properly.

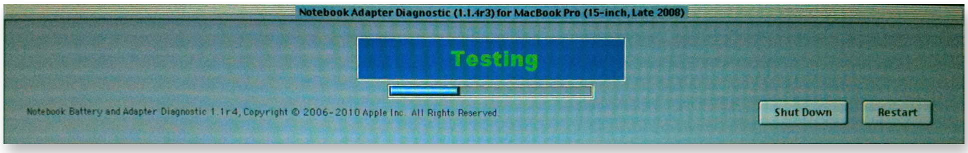
1. After launch on a portable UUT, NAD verifies that a valid system serial number is stored in firmware on the logic board. If it doesn't find one, the following dialog will appear.



Serial Number Needed

This system does not have a serial number. Please use Blank Board Serializer to set the serial number, then try again.

2. Next, NAD attempts to test the main battery in the UUT.



Notebook Adapter Diagnostic (1.1.4r3) for MacBook Pro (15-inch, Late 2008)

Testing

Notebook Battery and Adapter Diagnostic 1.1r4, Copyright © 2006-2010 Apple Inc. All Rights Reserved.

3. NAD reports three possible battery states: Good, Bad, and Consumed. If the battery is reported as bad or consumed, the test will immediately stop, and the test results will appear on the UUT's display.

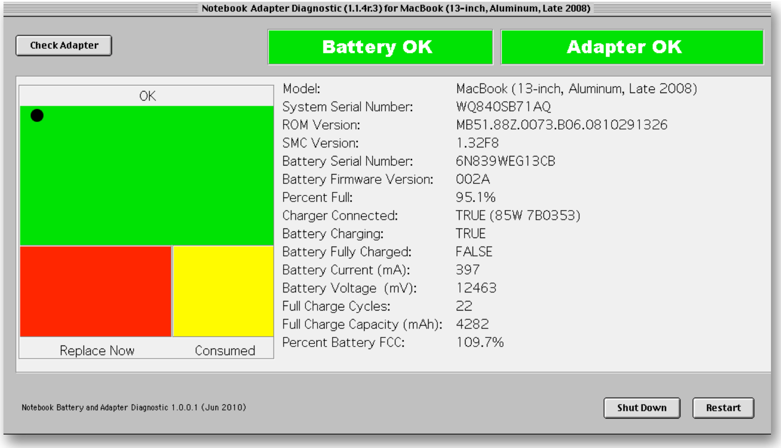
4. If the battery is reported as good, then the power adapter test runs automatically. If you do not have the correct power adapter connected, NAD will prompt you to connect one to the UUT before you can continue.

   Note: The power adapter test runs only if the battery is functioning properly. If you suspect the battery may be faulty and wish to separately test a suspect power adapter, please install a known-good battery, or run NAD on another computer with a known-good battery, to test the suspect power adapter.

5. NAD can detect the following failed power adapter states:
   - The power adapter is connected, but not charging when it should be.
   - The power adapter is connected, but its ID (serial number, plus other information) cannot be read.
   - Incorrect power adapter wattage detected.

6. Refer to CP165: **SERVICE: Notebook Computer Battery and Adapter Screening Process** (http://support.apple.com/kb/CP165) for more information about how to properly interpret and process NAD battery and power adapter test results.

7. NAD completes its diagnostic tests in less than a minute, and displays the results in a large, colorful, easy-to-read display.


Notebook Adapter Diagnostic (1.1.4r.3) for MacBook (13-inch, Aluminum, Late 2008)
Check Adapter
Battery OK
Adapter OK
OK
Replace Now
Consumed
Shut Down
Restart

Model:	MacBook (13-inch, Aluminum, Late 2008)
System Serial Number:	WQ840SB71AQ
ROM Version:	MB51.88Z.0073.B06.0810291326
SMC Version:	1.32F8
Battery Serial Number:	6N839WEG13CB
Battery Firmware Version:	002A
Percent Full:	95.1%
Charger Connected:	TRUE (85W 7B0353)
Battery Charging:	TRUE
Battery Fully Charged:	FALSE
Battery Current (mA):	397
Battery Voltage (mV):	12463
Full Charge Cycles:	22
Full Charge Capacity (mAh):	4282
Percent Battery FCC:	109.7%

Notebook Battery and Adapter Diagnostic 1.0.0.1 (Jun 2010)

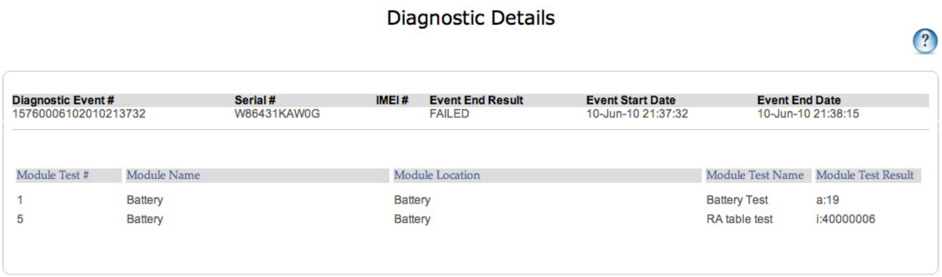
8. NAD diagnostic results for both the battery and power adapter are combined into a single log file that can be viewed using the Gateway Manager utility. See the table below for an example of an NAD AST test results log.

   Important: NAD in AST does not display or log any diagnostic receipt code. This code is not needed or used when running NAD in AST. The repair is validated through the NAD AST test results log data transmitted from NAD through the Diagnostic Gateway to the Apple Diagnostic Repository (ADR).

9. You do not need to look for, or enter, a diagnostic receipt code when using NAD in AST.

   Unlike the stand-alone version of NAD, where you input a validation code into the repair documentation system (GSX, iRepair, etc.) as proof you ran the diagnostic, NAD in AST and ADR systems are integrated with GSX and iRepair, making the process fully automatic.

10. NAD diagnostic results, like MRI diagnostic results, are immediately transmitted directly to GSX or iRepair, and appear as a Diagnostic Event in an open repair for a UUT, associated by its serial number.



Diagnostic Details

Diagnostic Event #	Serial #	IMEI #	Event End Result	Event Start Date	Event End Date
15760006102010213732	W86431KAW0G		FAILED	10-Jun-10 21:37:32	10-Jun-10 21:38:15

Module Test #	Module Name	Module Location	Module Test Name	Module Test Result
1	Battery	Battery	Battery Test	a:19
5	Battery	Battery	RA table test	i:40000006

NAD Log Example

```
GENERAL ToolName Notebook Adapter Diagnostic
GENERAL ToolVersion 1.1.4
GENERAL GMTDate 20110225_122056
PROFILE MLB 0 MLB MLB_SN W884100LY5W2A
PROFILE PROCESSOR 0 0 SPEED 2.4GHz
PROFILE PROCESSOR 0 0 MODEL Intel Core 2 Duo
PROFILE GPU 0 built-in2 MODEL NVIDIA GeForce 9400M
PROFILE GPU 1 built-in MODEL NVIDIA GeForce 9600M GT
PROFILE SOFTWARE Number Of  Mac OS X Bootable Volumes 0
DATA Battery Battery ATN1 Start_Ts_Local 1298665258 TEST_SEQ 0
DATA Battery Battery Battery Serial Number 6N8396WQ13EB
DATA Battery Battery Percent Full 99.7%
DATA Battery Battery Charger Connected TRUE (85W 5BE546)
DATA Battery Battery Battery Charging FALSE (Not needed)
DATA Battery Battery Percent Battery FCC 98.2%
DATA Battery Battery ITN5 Start_Ts_Local 1298665259 TEST_SEQ 1
RESULT Battery Battery ITN5 Passed 0  Indy RA Table Test End_
Ts_Local 1298665259 TEST_SEQ 1 Elapsed_seconds 0
RESULT Battery Battery ATN1 Passed 00 App Battery Test No
problems found. End_Ts_Local 1298665259 TEST_SEQ 0 Elapsed_
seconds 1
DATA Battery Battery Percent Full 99.7%
DATA Battery Battery Charger Connected TRUE (85W 5BE546)
DATA Battery Battery Charging FALSE (Not needed)
DATA Battery Battery Percent FCC 98.2%
DATA Battery Battery Self Status Good
DATA Battery Battery Full Charge Capacity 4322mA
DATA Battery Battery Capacity 4312mA
DATA Battery Battery Fully Charged TRUE
DATA Battery Battery Full Charge Cycles 109
DATA Battery Battery Design Cycle Count 500
DATA Battery Battery Is Consumed FALSE
DATA Battery Battery Current 0mA
DATA Battery Battery Voltage 12531mV
DATA Battery Battery Is Charger Connected TRUE
DATA Battery Battery Is Charging FALSE
DATA Battery Battery Number of Cells 3
DATA Battery Battery Cell 1 voltage 4177mV
DATA Battery Battery Cell 2 voltage 4176mV
DATA Battery Battery Error Condition No Error
DATA Battery Battery Status Flag 0x40E0
DATA Battery Battery temp, sensor 1 30.000¬∞C
DATA Battery Battery temp, sensor 2 28.500¬∞C
DATA Battery Battery sleep-drain/hr n/a
DATA Battery Battery cell imbalance spec 15
DATA Battery Battery PF Status 0x0000
DATA Battery Battery Instant Battery Current 0mA
DATA Battery Battery Serial Number 6N8396WQ13EB
DATA Battery Battery Firmware Version 002A
DATA Battery Battery reserve 200
DATA Battery Battery manufacturer SMP
DATA Battery Battery device name bq20z951
DATA Battery Battery SMART Battery Serial Number SMP-
bq20z951-39
DATA Battery Battery Pack Serial Number 6N8396WQ13EB
DATA Battery Battery #secs !chrge abs tmp n/a
DATA Battery Battery #secs !chrge grd tmp n/a
DATA Battery Battery #secs lmt chrge abs tmp n/a
DATA Battery Battery #secs lmt chrge grd tmp n/a
DATA Battery Battery #secs lmt chrge blv tmp n/a
DATA Battery Battery Hardware Revision 000A
DATA Battery Battery Cell Revision 0100
DATA Battery Battery Pack Lot Code 0000
DATA Battery Battery Is AC LED Controllable TRUE
DATA Battery Battery Manufacture Date 25-9-2008
DATA ADAPTER MLB Wattage 85W
DATA ADAPTER MLB Revision 0
DATA ADAPTER MLB Serial Number 5BE546
DATA ADAPTER MLB Family Code BA
DATA ADAPTER ATN1 Start_Ts_Local 1298665260 TEST_SEQ 2
DATA Battery ATN2 Start_Ts_Local 1298665427 TEST_SEQ 4
RESULT Battery ATN2 Passed 00  App Charging Test End_Ts_Local
1298665432 TEST_SEQ 4 Elapsed_seconds 5
DATA ACAdapterPort 0 ITN4 Start_Ts_Local 1298665432 TEST_SEQ 5
RESULT ACAdapterPort 0 ITN4 Passed 0  Indy AC Adapter
Disconnect Connect Test End_Ts_Local 1298665443 TEST_SEQ 5
Elapsed_seconds 11
DATA ACAdapterPort 0 ITN5 Start_Ts_Local 1298665443 TEST_SEQ 6
RESULT ACAdapterPort 0 ITN5 Passed 0  Indy Adapter Check
Current within limits End_Ts_Local 1298665443 TEST_SEQ 6
Elapsed_seconds 0
RESULT ADAPTER ATN1 Passed 00  App Adapter Check End_Ts_Local
1298665443 TEST_SEQ 2 Elapsed_seconds 183
DATA Battery Battery Percent Full 94.9%
DATA Battery Battery Charger Connected TRUE (85W 5BE546)
DATA Battery Battery Charging TRUE
DATA Battery Battery Percent FCC 98.1%
DATA Battery Battery Self Status Good
DATA Battery Battery Full Charge Capacity 4320mA
DATA Battery Battery Capacity 4103mA
DATA Battery Battery Fully Charged FALSE
DATA Battery Battery Full Charge Cycles 109
DATA Battery Battery Design Cycle Count 500
DATA Battery Battery Is Consumed FALSE
DATA Battery Battery Current 368mA
DATA Battery Battery Voltage 12389mV
DATA Battery Battery Is Charger Connected TRUE
DATA Battery Battery Is Charging TRUE
DATA Battery Battery Number of Cells 3
DATA Battery Battery Cell 1 voltage 4134mV
DATA Battery Battery Cell 2 voltage 4125mV
DATA Battery Battery Error Condition No Error
DATA Battery Battery Status Flag 0x80
DATA Battery Battery temp, sensor 1 31.796¬∞C
DATA Battery Battery temp, sensor 2 29.898¬∞C
DATA Battery Battery sleep-drain/hr n/a
DATA Battery Battery cell imbalance spec 15
DATA Battery Battery PF Status 0x0000
DATA Battery Battery Instant Battery Current -1031mA
DATA ADAPTER MLB Wattage 85W
DATA ADAPTER MLB Revision 0
DATA ADAPTER MLB Serial Number 5BE546
DATA ADAPTER MLB Family Code BA
```

Using Test Patterns Tool (TPT)

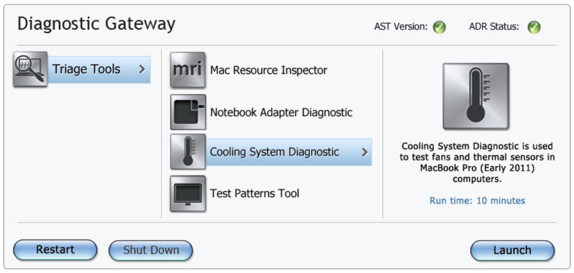
Test Patterns Tool (TPT) identifies pixel anomalies in LCD panels with LED backlighting in Apple Display, iMac, MacBook, MacBook Pro, and MacBook Air systems. You will be required to use TPT before ordering replacement display panels from Apple.

TPT displays nine screen tests and requires a technician to determine if the display being tested passes each test. A log of these results is created by TPT.

Note: TPT is not available on some Apple portable models. If the AST menu does not list TPT, then it is not applicable to the UUT you are testing.

How To Use TPT on Products with Built-In Displays

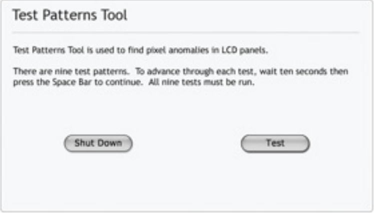
1. Connect the UUT to the Apple Service Toolkit server and launch AST. From the Apple Diagnostic Gateway screen, select TPT.



Cooling System Diagnostic is used to test fans and thermal sensors in MacBook Pro (Early 2011) computers.

Run time: 10 minutes

2. Click the test button in the main TPT window. This will bring up the first test.

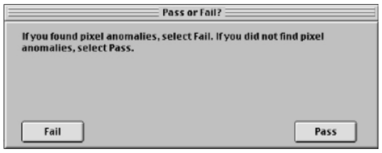


Test Patterns Tool is used to find pixel anomalies in LCD panels.

There are nine test patterns. To advance through each test, wait ten seconds then press the Space Bar to continue. All nine tests must be run.

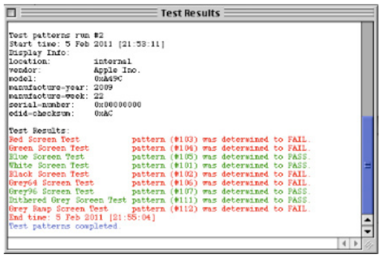
3. The first test runs a red screen. Examine the LCD closely for any pixel anomalies.

4. When you have finished your inspection, press the space bar. If you find any pixel anomalies, select the Fail button in the dialog box below. If you do not see any pixel anomalies, select the Pass button. Once you make a selection, you will taken to the next test.



If you found pixel anomalies, select Fail. If you did not find pixel anomalies, select Pass.

Between tests, you will see a Test Results screen like the one below.



```
Test patterns run #2
Start time: 5 Feb 2011 [21:53:11]
Display Info:
location:          internal
vendor:            Apple Inc.
model:             0xA49C
manufacture-year:  2009
manufacture-week:  22
serial-number:     0x00000000
edid-checksum:     0xAC

Test Results:
Red Screen Test            pattern (#103) was determined to FAIL.
Green Screen Test          pattern (#104) was determined to FAIL.
Blue Screen Test           pattern (#105) was determined to PASS.
White Screen Test          pattern (#101) was determined to PASS.
Black Screen Test          pattern (#102) was determined to FAIL.
Grey64 Screen Test         pattern (#106) was determined to FAIL.
Grey96 Screen Test         pattern (#107) was determined to PASS.
Dithered Grey Screen Test  pattern (#111) was determined to PASS.
Grey Ramp Screen Test      pattern (#112) was determined to FAIL.
End time: 5 Feb 2011 [21:55:04]
Test patterns completed.
```

5. Repeat this process for all of the nine tests.
   - Red Screen
   - Green Screen
   - Blue Screen
   - White Screen
   - Black Screen
   - Grey64 Screen
   - Grey96 Screen
   - Dithered Grey Screen
   - Grey Ramp Screen
6. When you have finished the tests, select Shut Down in the main window to finish using TPT.

How to use TPT on Stand-Alone Displays

To test a stand-alone display, you need the following items:

- MacBook, MacBook Air, or MacBook Pro
- Keyboard
- Mouse

1. Connect the power cable of the display to the AC outlet.
2. Connect the stand-alone display to the portable.
3. Connect the Universal MagSafe cable of the display to the selected computer.
4. Connect a mouse to a keyboard.
5. Connect the keyboard with the mouse connected to the selected computer.
6. Connect Ethernet cable from the Gateway server or USB hard or flash drive to the portable.
7. Start up the Mac then immediately close the lid, and press either the N key or Option key.

   NOTE: The timing to close the lid is very important. If the timing is off, TPT will not launch.
8. Once AST loads, follow directions in the previous section for products with built-in displays.

Shortcut Keys

S(hut down) and **T**(est). These keys are only active at the main window.

TPT Log Example

```
GENERAL ToolName Test Patterns Tool
GENERAL ToolVersion 1.0
GENERAL GMTDate 20110225_122950

DATA DisplayDisplayPort ITN103 Start_Ts_Local 1298665788 TEST_SEQ 0
RESULT DisplayDisplayPort ATN103 Passed 1  App Red Screen Test End_Ts_Local 1298665803 TEST_SEQ
0 Elapsed_seconds 15

DATA DisplayDisplayPort ITN104 Start_Ts_Local 1298665803 TEST_SEQ 1
RESULT DisplayDisplayPort ATN104 Passed 1  App Green Screen Test End_Ts_Local 1298665816 TEST_
SEQ 1 Elapsed_seconds 13

DATA DisplayDisplayPort ITN105 Start_Ts_Local 1298665816 TEST_SEQ 2
RESULT DisplayDisplayPort ATN105 Passed 1  App Blue Screen Test End_Ts_Local 1298665852 TEST_
SEQ 2 Elapsed_seconds 36

DATA DisplayDisplayPort ITN101 Start_Ts_Local 1298665852 TEST_SEQ 3
RESULT DisplayDisplayPort ATN101 Passed 1  App White Screen Test End_Ts_Local 1298665865 TEST_
SEQ 3 Elapsed_seconds 13

DATA DisplayDisplayPort ITN102 Start_Ts_Local 1298665865 TEST_SEQ 4
RESULT DisplayDisplayPort ATN102 Passed 1  App Black Screen Test End_Ts_Local 1298665879 TEST_
SEQ 4 Elapsed_seconds 14

DATA DisplayDisplayPort ITN106 Start_Ts_Local 1298665879 TEST_SEQ 5
RESULT DisplayDisplayPort ATN106 Passed 1  App Grey64 Screen Test End_Ts_Local 1298665889 TEST_
SEQ 5 Elapsed_seconds 10

DATA DisplayDisplayPort ITN107 Start_Ts_Local 1298665889 TEST_SEQ 6
RESULT DisplayDisplayPort ATN107 Passed 1  App Grey96 Screen Test End_Ts_Local 1298665900 TEST_
SEQ 6 Elapsed_seconds 11

DATA DisplayDisplayPort ITN111 Start_Ts_Local 1298665900 TEST_SEQ 7
RESULT DisplayDisplayPort ATN111 Passed 1  App Dithered Grey Screen Test End_Ts_Local
1298665910 TEST_SEQ 7 Elapsed_seconds 10

DATA DisplayDisplayPort ITN112 Start_Ts_Local 1298665910 TEST_SEQ 8
RESULT DisplayDisplayPort ATN112 Passed 1  App Grey Ramp Screen Test End_Ts_Local 1298665926
TEST_SEQ 8 Elapsed_seconds 16
```

Cooling System Diagnostic (Standard and Extended)

Cooling System Diagnostic (CSD) evaluates thermal sensors, fans and heat sinks in MacBook Pro (Early and Late 2011), MacBook Air (Mid 2011) and iMac (Mid and Late 2011). It confirms correct operation and helps diagnose service issues. CSD is useful when addressing questions about fan noise.

Learn about the fans in your Mac: http://support.apple.com/kb/HT4543.

Supported Products

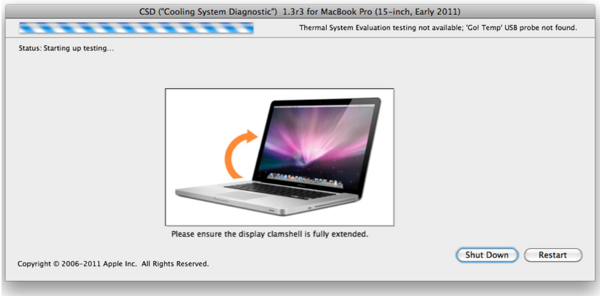
Run Cooling System Diagnostic whenever a customer brings up an issue of fan noise on any of these systems:

- MacBook Pro (13-, 15-, 17-inch, Early and Late 2011)
- MacBook Air (11-, 13-inch, Mid 2011)
- iMac (21.5-, 27-inch, Mid and Late 2011)

Guided Walkthrough for Standard and Extended Thermal Tests

AST provides an extended Cooling System Diagnostic test for MacBook Pro (Early and Late 2011) and MacBook Air (Mid 2011) to troubleshoot intermittent thermal issues. This 30–40 minute test, designed for use at the repair bench, fully checks thermal efficiencies in MacBook Pro (Early and Late 2011) and MacBook Air (Mid 2011). This test requires a USB ambient temperature sensor, available for order via GSX (part number 922-9911).

Upon launch, the main CSD test window indicates whether or not the temperature probe is connected beforehand. **Note**: If CSD does not detect the probe, the test assumes you have elected not to run the 4th extended test.



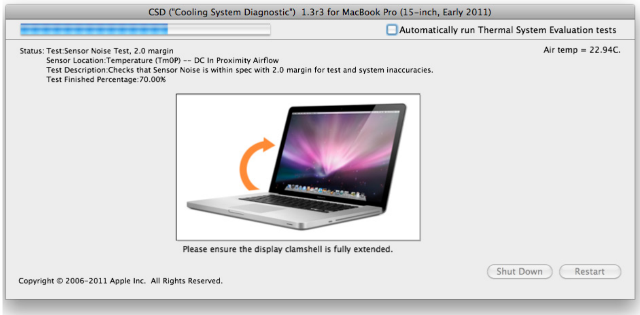
CSD ("Cooling System Diagnostic") 1.3r3 for MacBook Pro (15-inch, Early 2011)

Thermal System Evaluation testing not available; 'Go! Temp' USB probe not found.

Status: Starting up testing...

Please ensure the display clamshell is fully extended.

If you connect the external probe before launching CSD, the startup window displays the ambient air temperature in degrees Celsius, and an "Automatically run Thermal System Evaluation tests" checkbox appears in the upper-right corner.



CSD ("Cooling System Diagnostic") 1.3r3 for MacBook Pro (15-inch, Early 2011)

☐ Automatically run Thermal System Evaluation tests

```
Status: Test:Sensor Noise Test, 2.0 margin
        Sensor Location:Temperature (Tm0P) -- DC In Proximity Airflow
        Test Description:Checks that Sensor Noise is within spec with 2.0 margin for test and system inaccuracies.
        Test Finished Percentage:70.00%
```

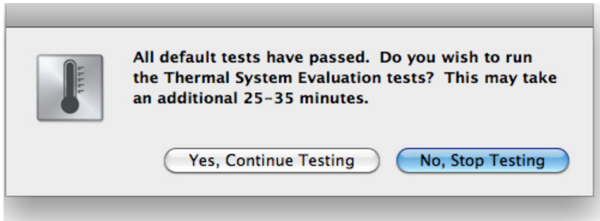
Air temp = 22.94C.

Please ensure the display clamshell is fully extended.

Click this checkbox only if you are certain you want to run all four tests in a row—including the extended test—without pause. Keep in mind that all four tests back to back can take as long as 50 minutes to run. This checkbox is a safety feature to prevent CSD from automatically executing the 30–40 minute extended test without your input.

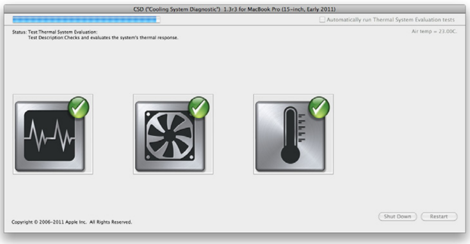
Note: If you do not click the checkbox, you still retain the option to run the extended test later. The checkbox remains live for a few minutes into the first test, after which it becomes grayed out.

If you aren't sure whether you want to run the extended test yet, or you only want to run the first three tests, which take 7–10 minutes, leave this option unchecked. After CSD finishes the first three tests, a dialog box will prompt you to run the extended test or stop testing at that point.



All default tests have passed. Do you wish to run the Thermal System Evaluation tests? This may take an additional 25-35 minutes.

As each test finishes, an icon with a badge informs you whether the test passed or failed. You can click on each icon for more detailed information.


CSD ("Cooling System Diagnostic") 1.3r3 for MacBook Pro (15-inch, Early 2011)
Automatically run Thermal System Evaluation tests
Shut Down
Restart

Status: Test:Thermal System Evaluation:
Test Description:Checks and evaluates the system's thermal response.

Air temp = 23.00C.

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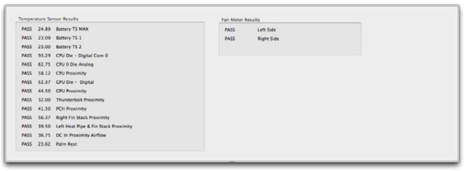
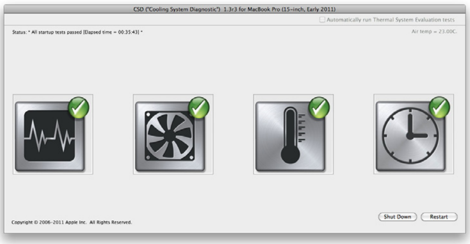


```
Temperature Sensor Results
PASS   24.89   Battery TS MAX
PASS   23.09   Battery TS 1
PASS   23.00   Battery TS 2
PASS   93.29   CPU Die - Digital Core 0
PASS   62.75   CPU 0 Die Analog
PASS   58.12   CPU Proximity
PASS   52.37   GPU Die -  Digital
PASS   44.50   GPU Proximity
PASS   32.00   Thunderbolt Proximity
PASS   41.50   PCH Proximity
PASS   56.37   Right Fin Stack Proximity
PASS   39.50   Left Heat Pipe & Fin Stack Proximity
PASS   36.75   DC In Proximity Airflow
PASS   23.62   Palm Rest

Fan Motor Results
PASS        Left Side
PASS        Right Side
```

Shown below is the result window with the 4th extended test included.


CSD ("Cooling System Diagnostic") 1.3r3 for MacBook Pro (15-inch, Early 2011)
Automatically run Thermal System Evaluation tests
Shut Down
Restart

Status: * All startup tests passed [Elapsed time = 00:35:43] *

Air temp = 23.00C.

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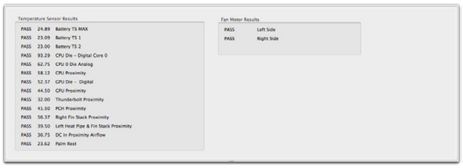
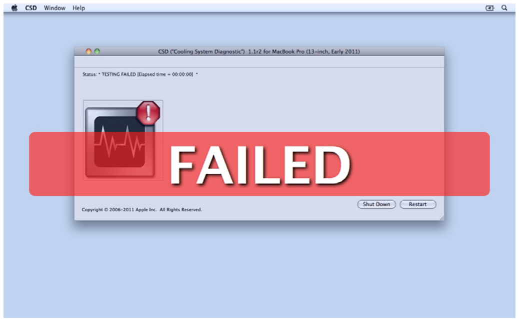


```
Temperature Sensor Results
PASS   24.89   Battery TS MAX
PASS   23.09   Battery TS 1
PASS   23.00   Battery TS 2
PASS   93.29   CPU Die - Digital Core 0
PASS   62.75   CPU 0 Die Analog
PASS   58.12   CPU Proximity
PASS   52.37   GPU Die -  Digital
PASS   44.50   GPU Proximity
PASS   32.00   Thunderbolt Proximity
PASS   41.50   PCH Proximity
PASS   56.37   Right Fin Stack Proximity
PASS   39.50   Left Heat Pipe & Fin Stack Proximity
PASS   36.75   DC In Proximity Airflow
PASS   23.62   Palm Rest

Fan Motor Results
PASS        Left Side
PASS        Right Side
```

If any CSD test components fail, you will see a window with a “FAILED” banner.


CSD
Window
Help
CSD ("Cooling System Diagnostic") 1.1r2 for MacBook Pro (13-inch, Early 2011)
FAILED
Shut Down
Restart

Status: * TESTING FAILED [Elapsed time = 00:00:00] *

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Cooling System Diagnostic Best Practices

- Before running CSD, set up the user's computer on a hard, flat, stable work surface (desk, table, counter, etc.) that allows for adequate air circulation under and around the computer.
- Do not operate the computer on a pillow, pad, soft ESD mat, packing foam, or any other soft material, as the material can block the airflow vents and/or prevent adequate air circulation under the computer.
- Be sure the display clamshell is fully open, as shown in the photo in the CSD startup screen. This ensures that the computer has adequate airflow for the duration of the test.
- Never place anything over the keyboard when operating the computer.
- Check the user's computer for any missing feet, bottom case deformation or damage, or anything that could cause the computer not to sit flat on a hard, flat surface.
- Run CSD only if the computer can sit flat on a hard, flat, stable surface. If the computer cannot sit flat, consider performing service on the computer for that issue.
- Never push objects into the ventilation openings.

Running Cooling System Diagnostic

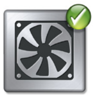
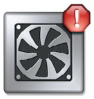
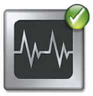
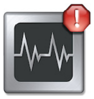
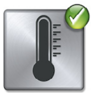
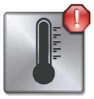
1. Make sure that the computer is plugged in to a known-good power supply.
2. NetBoot the system to AST.
3. Choose the Cooling System Diagnostic from the AST menu.
4. The computer will restart and boot into the AST OS, immediately running the Cooling System Diagnostic.
5. The sensor test checks all thermal sensors and determines whether they are operating within expected boundaries.
6. The fan test then runs the fans at low speed and confirms that they are operating within specifications. Next, the fans are run at high speed and are checked again for conformance to specification.
7. The thermal interface test, which takes up to 2 minutes to perform, verifies the effectiveness of the CPU die–heat sink bond by thermally stressing the CPU and measuring the difference between CPU die and heat sink temperatures, which should be minimal. This test provides an indication of how well the heat sink is secured over the CPU and to the logic board.

Important Notes About The Extended Thermal System Evaluation Test

- The 30-minute Extended Thermal System Evaluation test is available only for MacBook Pro (Early and Late 2011) and MacBook Air (Mid and Late 2011) computers. The extended test does will not run on iMac (Mid 2011) computers.
- This test is not recommended for initial triage due to the length of the test (30–40 minutes).
- This test runs as the fourth and last in the series of thermal tests—after the previous three (sensor, fan and thermal interface) tests complete.

- The extended version of CSD requires that an external ambient temperature sensor be connected to one of the computer's USB ports before the test is run. If no sensor is connected, the three standard thermal tests will run, simply skipping the final extended test.
- The extended test requires that the computer have at least a 90% battery charge before it will begin testing. The test will wait until the battery is sufficiently charged before starting. This delay may significantly lengthen the testing time beyond 30–40 minutes.
- After the test completes, the computer's battery will be drained to approximately 50-60%, even with the computer connected to a power adapter. This is normal behavior, as normal thermal and battery constraints are temporarily reprogrammed to thoroughly evaluate the thermal system during the test.

Interpreting Test Results

MRI Icon	Description
	All fan test checks passed and are within operational specifications.
	Individual fan check failed. **Troubleshooting tip**: Check connections to the logic board. Verify that the fan connector is secured to the logic board. A loose or disconnected fan cable connector to the logic board may affect fan failures. Check for dust or debris in the fan.
	All thermal sensor checks passed and are within operational specifications.
	Thermal sensor checks failed. **Troubleshooting tip**: Verify that all thermal connections to the logic board are secure.
	All cooling controls passed and are within operational specifications.
	Cooling control checks failed. **Troubleshooting tip**: Verify that the heat sink is properly secured to the logic board.

Server Bit Setter

After a logic board or backplane has been replaced in a Mac server, Server Bit Setter (SBS) resets the internal component that identifies that computer as a server. SBS appears under Repair Tools in the Diagnostic Gateway screen of Apple Service Toolkit.

For more information, refer to Apple support article HT4468: Using Server Bit Setter

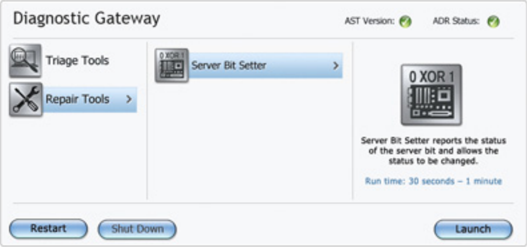
When to Use Server Bit Setter

Use Server Bit Setter only after replacing the logic board in a Mac mini (Mac OS X Server, Late 2009) or Mac mini Server (Mid 2010 and Mid 2011), or the backplane board in Mac Pro (Mid 2010) with Mac OS X Server, or after the creation of a serial number using Blank Board Serializer.

Note: Server Bit Setter will appear in AST *only* if the computer is one of these three models.

How to Use Server Bit Setter

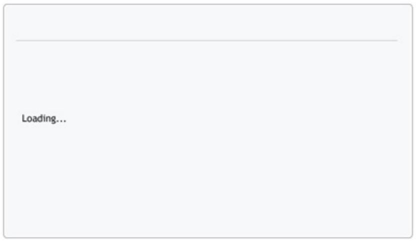
1. NetBoot the computer to AST, select Repair Tools, and then double-click Server Bit Setter.



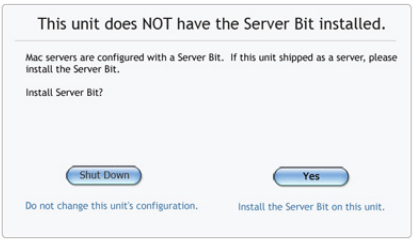
Server Bit Setter reports the status of the server bit and allows the status to be changed.

Run time: 30 seconds – 1 minute

2. A loading screen appears. The next screen should report that the computer does not have the server bit installed. Click Yes to install the server bit.



Loading...



This unit does NOT have the Server Bit installed.

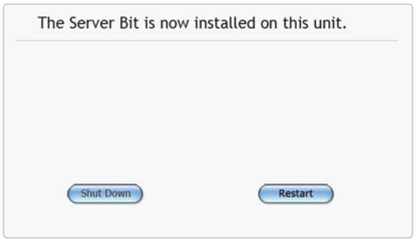
Mac servers are configured with a Server Bit. If this unit shipped as a server, please install the Server Bit.

Install Server Bit?

Do not change this unit's configuration.

Install the Server Bit on this unit.

3. A confirmation screen appears once installation is complete.



The Server Bit is now installed on this unit.

Video System Test (VST)

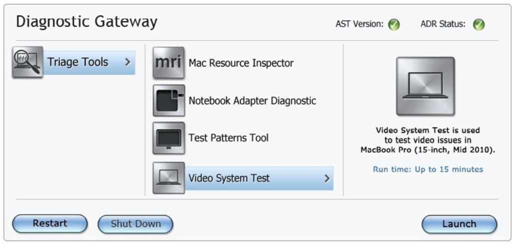
Video System Test (VST) tests MacBook Pro (15-inch, Mid 2010) computers for intermittent display issues in situations where the computer has passed all MRI tests.

Note: For detailed instructions regarding when and how to use VST, refer to Apple Service article TS4088: MacBook Pro (15-inch, Mid 2010): Intermittent black screen or loss of video. Click the GSX link under **Service Provider Comments** toward the bottom of the page to access the service-related procedure.

VST requires AST OS 5, a separate OS X Lion disk image. Download the image components at Apple Support article HT4595: Latest Apple Service Toolkit Download Links and Documentation.

Using MRI and VST

1. Before running MRI, make sure all software and firmware updates have been installed.
2. Start up or restart the computer, holding down the N key to Netboot to AST.
3. From the AST diagnostic menu, select MRI. Run MRI through its entire test suite.
4. Troubleshoot any issues reported by MRI before proceeding.
5. If the computer passes all MRI tests, shutdown the computer by pressing the S key.
6. Start up the computer again, holding down the N key during startup to Netboot to the AST diagnostic menu.
7. From the AST diagnostic menu, select Video System Test.

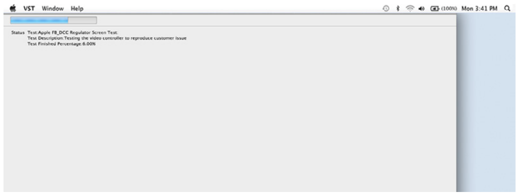


Video System Test is used to test video issues in MacBook Pro (15-inch, Mid 2010).

Run time: Up to 15 minutes

Important: If after selecting VST from the AST diagnostic menu you receive the message "Error Loading Kernel 0x12," there may be a network switch incompatibility issue. To work around this issue, access the AST server using a different switch. Escalate to TSPS if you need further support.

8. The computer should start up in OS X, and then launch Video System Test.



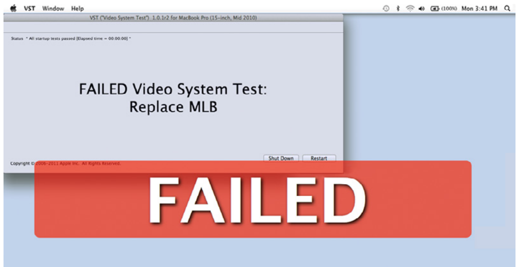
```
Status  Test:Apple FB_DCC Regulator Screen Test:
        Test Description:Testing the video controller to reproduce customer issue
        Test Finished Percentage:6.00%
```

9. If the computer does not complete Video System Test, hanging at a black screen, shut down the computer by pressing and holding the power button.

10. Start up the computer again, holding down the N key during startup to Netboot to the AST diagnostic menu.

11. Run Video System Test once more. This time the test should start up, detect the faulty shutdown, and a message will appear:

    "FAILED Video System Test: Replace MLB"



VST ("Video System Test") 1.0.1r2 for MacBook Pro (15-inch, Mid 2010)

Status * All startup tests passed [Elapsed time = 00.00.00] *

FAILED Video System Test:
Replace MLB

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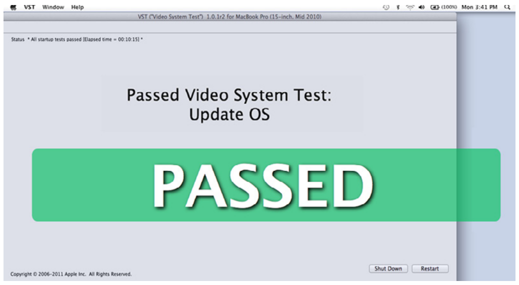
12. If a computer passes VST, one of two messages will appear:

    "Passed Video System Test: Update OS"



VST ("Video System Test") 1.0.1r2 for MacBook Pro (15-inch, Mid 2010)

Status * All startup tests passed [Elapsed time = 00:10:15] *

Passed Video System Test:
Update OS

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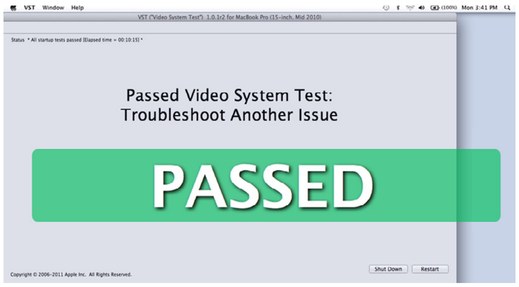
"Passed Video System Test: Troubleshoot Another Issue"



VST ("Video System Test") 1.0.1r2 for MacBook Pro (15-inch, Mid 2010)

Status * All startup tests passed [Elapsed time = 00:10:15] *

Passed Video System Test:
Troubleshoot Another Issue

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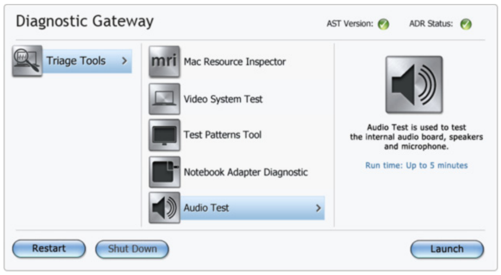
Note: The above dialog boxes may appear without the red or green passed/failed banners.

13. After getting a pass or fail result on the screen, you will need to run MRI once more if you wish to run VST again on the UUT.

NEW!

Using Audio Test

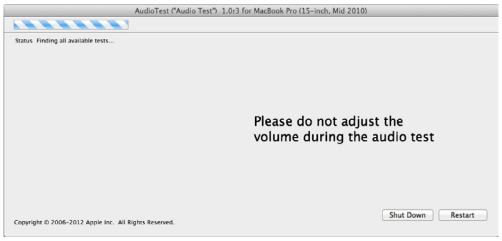
1. Launch Audio Test from AST menu.



Audio Test is used to test the internal audio board, speakers and microphone.

Run time: Up to 5 minutes

2. The UUT NetBoots into the test. It may take a few minutes for AST to load and begin the test.



AudioTest ("Audio Test") 1.0r3 for MacBook Pro (15-inch, Mid 2010)

Status Finding all available tests...

Please do not adjust the volume during the audio test

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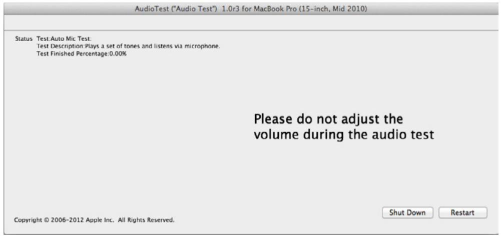
3. Audio Test plays a sequence of tones from various speakers (left, right, subwoofer, etc.).



AudioTest ("Audio Test") 1.0r3 for MacBook Pro (15-inch, Mid 2010)

Status Test:Auto Mic Test:
Test Description:Plays a set of tones and listens via microphone.
Test Finished Percentage:0.00%

Please do not adjust the volume during the audio test

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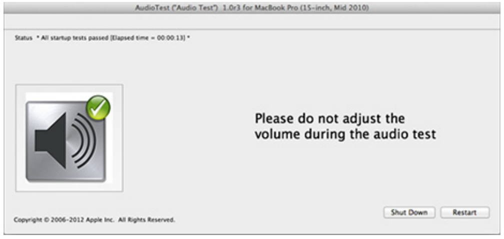
4. As the test plays each tone sequence, it simultaneously listens for these same tones through the UUT's built-in microphone. Any missing or distorted tones are isolated to the malfunctioning speaker channel(s).

   Note: Although the tones may sound like they are all coming from all speakers, they are not. This is how the test can tell which speaker channel(s) may be malfunctioning.

5. If Audio Test accurately detects all the tones, the test passes. If one or more tones are distorted or not detected properly, the test fails.



AudioTest ("Audio Test") 1.0r3 for MacBook Pro (15-inch, Mid 2010)

Status * All startup tests passed [Elapsed time = 00:00:13] *

Please do not adjust the volume during the audio test

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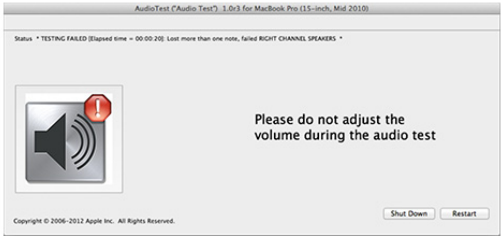

AudioTest ("Audio Test") 1.0r3 for MacBook Pro (15-inch, Mid 2010)

Status * TESTING FAILED [Elapsed time = 00:00:20]: Lost more than one note, failed RIGHT CHANNEL SPEAKERS *

Please do not adjust the volume during the audio test

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UUT Information Sent to Apple

AST receives diagnostic information from each UUT running AST checks or tests. It gathers the information into log files and sends them to Apple Diagnostic Repository. These logs contain:

- diagnostic test results (described in other sections of this document)
- information about the hardware configuration of the computer (described in other sections of this document)
- information about OS X and any iLife applications installed on hard disks that are detected and checked (described here)

The DG locally stores these logs for a only limited amount of time. The hard disk volume and software information that is collected and sent to Apple Diagnostic Repository consists of the following data.

Hard disk volume information

- Number of hard disk volumes with OS X installed
- Volume size
- Volume free space
- Mac OS build version (e.g., 10.6.2)
- Mac OS build number (e.g., 10C540)
- Server or non-server version
- **Note**: MRI displays volume names on the UUT's display only. Volume names are not collected.

iLife info

- iPhoto version
- iMovie or iMovie HD version
- GarageBand version
- iWeb version
- iDVD version
- iLife version

Note: iLife version is not determined directly from hard disk, but rather is inferred from the iPhoto version; if iPhoto doesn't exist, MRI will not attempt to find other iLife applications.

It is important to understand that to ensure customers' privacy only this information, and nothing else, is scanned or collected from UUTs by AST. The information collected is no more detailed than what would normally be gathered when a Mac is brought to any AASP or Apple Retail Store.

Interpreting MRI Results

Badge Color Coding

Each icon shows a green, yellow, or red badge indicating status.

When MRI performs its checks, it knows what model features should be present and installed—for example, which Macs have SD boards, Bluetooth, and AirPort built-in, which do not, and which have this hardware optional (i.e., good / better / best / CTO differences). MRI decodes this information from several parameters, including the configuration code in the serial number.

If the module, component, or subsystem is expected and not optional for that configuration, then MRI verifies that it can communicate with the hardware. The results of this 'presence' check can be only green (found and communicated OK) or red (not found, did not communicate).

MRI cannot 'fail' a module, component, or subsystem that is optional, since it has no way of determining whether that optional module, component, or subsystem is actually present in that particular configuration.

If the module, component, or subsystem is not expected, and not optional for that configuration, then MRI skips that check and displays no icon for that module, component, or subsystem. For example, battery and power adapter tests in Mac desktops are skipped.

✓ Green = OK (module, component or subsystem expected, found and checked)

Green indicates that the expected module, component or subsystem was expected, found, and successfully communicated with MRI.

⚠ Yellow = Caution, or indeterminate check results

This indication does not necessarily mean failure; it flags the technician to investigate further. It may be that the component being checked was expected but not found, or not expected but found (a CTO option, for instance). The system may have extra RAM, different-sized hard drive, etc.

MRI can decode model characteristics, such as which Macs have SD boards, Bluetooth, and AirPort built-in and which have hardware optional. This means that if MRI cannot communicate with the Bluetooth module, for example, on a Mac where it was an optional component, it will not be able to determine whether or not this is a problem. In those cases, MRI highlights the module as yellow, and adds a note inform the user that the feature was optional on that model.

So, for example, if AirPort is not expected for the configuration of Mac you are working with, and you see an AirPort icon with a yellow badge, then you can safely ignore the yellow caution. Otherwise, you should investigate yellow results further.

Special Tips for Battery Icon with Yellow Badge

- If the battery icon displays a yellow badge it means that the battery may have failed, but is also consumed (the only situation where a failure is coded yellow).
- If the battery icon has a yellow badge, diminished performance of the battery is not covered under warranty or AppleCare since it may have been exceeded its charge cycle capacity (i.e., it has been consumed). Your customer may want to purchase a replacement battery to improve performance or minimize computer usage on battery power.

Troubleshooting Tip: If the battery icon displays a yellow badge, run the Notebook Adapter Diagnostic after running MRI. You can do this easily by restarting the UUT, then selecting this option from the menu. For more information about the Notebook Adapter Diagnostic, please see http://support.apple.com/kb/CP165.

Red = Check failed

Indicates the expected module, component or subsystem was not found. This means the module, component or subsystem being checked could:

- have a loose cable connection
- be missing entirely
- be malfunctioning

Either way, it did not communicate when MRI expected it to do so. This means you should focus your troubleshooting efforts on isolating the issue to symptoms involving the failed module(s), component(s) or subsystem(s) first, using these results and information found in the product's Apple Technician Guide troubleshooting section.

IMPORTANT: Do not imply to the customer that a module or component requires replacement just because its MRI check icon displays a yellow or red badge.

Always follow up with more thorough troubleshooting steps using the UUT's latest Apple Technician Guide before replacing any parts.

Interpreting AST Results with No Video

When you run AST diagnostics on a UUT with normal video, you can navigate the software using your mouse and keyboard, and you can observe the results of the diagnostic tests on the UUT's primary display. When you test a UUT with no video, you will rely on other means to navigate and execute diagnostic tests, and you can observe test results using the DG Mac's logging capability.

Here are some tips to assist your triage of a UUT with a 'no video' condition, when running AST diagnostics such as MRI or NAD.

Set AST as the Default NetBoot Image

AST diagnostics are NetBooted from the DG. If you want to use AST with an existing NetBoot server, you should configure your NetBoot server so that the AST NetBoot image is the default image for that server. This is because only the default NetBoot image gets loaded when 'N' is held down, whereas all other images must be selected with Startup Manager (hold Option key down at startup and select the correct volume to NetBoot).

On a UUT with no video, it is much easier to select the correct NetBoot image volume by simply holding down the 'N' key, than it is to try to select the correct image using Startup Manager.

Refer to the section titled AST Diagnostic Gateway System Networking Requirements and follow the steps for 'Scenario 2.'

Connect an External Display

If possible, connect a compatible external display to the UUT. Remember that MRI will always select and use the internal display if it can detect its presence (i.e. if connected), even if an external display is also connected.

If MRI cannot detect the presence of an internal display, and an external display is also connected, then MRI will use the external display as its primary (and only supported) display.

Observe the Sleep Indicator Light

The UUT's sleep indicator light may change from off to on, or it may pulsate as in sleep mode, during certain phases of AST operation. Refer to the section titled UUT Sleep Indicator Light Behavior for more information on these visual clues.

Observe the UUT's sleep indicator light while running AST to determine the diagnostic's current phase of operation. It can tell you if the diagnostic is running, completed, or awaiting user input.

Use Keyboard Navigation

With no video on the UUT, you cannot see to navigate AST diagnostics such as MRI. Refer to the section titled AST Keyboard Operation for information on how to navigate through MRI or NAD using keyboard keys instead of the mouse. Please note that some diagnostics may not have keyboard navigation capability.

When AST presents the customer permissions dialog on the UUT's display immediately after NetBooting, you can answer this dialog by pressing the 'Y' key for yes, to advance to the menu. You can press the 'S' key to answer no and shut down the UUT if the customer declines.

At the menu, you can press the right arrow key once to move the selection to the first entry (MRI), and then use the down arrow to select the next entry in the list (NAD). Pressing return or enter launches the selected diagnostic.

Also be aware that MRI automatically launches after 15 seconds of inactivity at the main menu.

Find the UUT's test log via the Gateway Manager

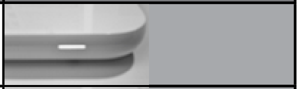
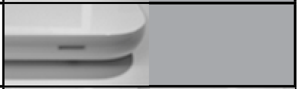
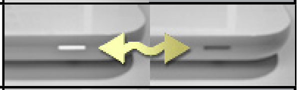
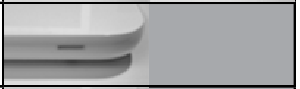
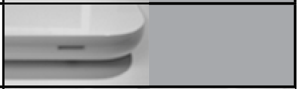
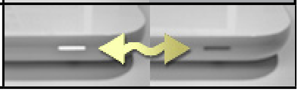
With no video on the UUT, you cannot see the results of AST diagnostics. However, AST gathers log information for all checks/tests run on the UUT regardless of its video status.

Refer to the section titled Using Gateway Manager to Access UUT Logs for more information about how to view the UUT's test log on the DG Mac or another Mac on your LAN running Gateway Manager. The log can tell you which UUT checks/tests passed and which failed.

UUT Sleep Indicator Light Behavior

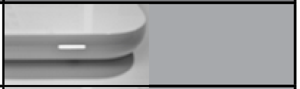
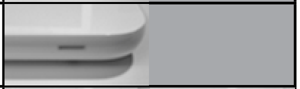
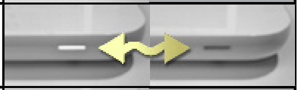
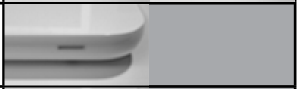
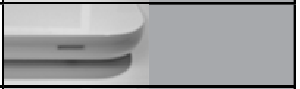
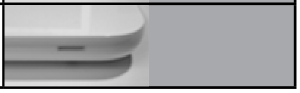
The behavior of the UUT's sleep indicator light (SIL) will change with each phase of the MRI and NAD diagnostic workflow, helping the technician to navigate from one phase to the next.

MRI Sleep Indicator Light Behavior

MRI Phase	SIL Behavior	SIL Example
1—Startup Chime	On	
2—NetBoot	Off	
3—Permission Dialog	Pulsing (similar to sleep)	
4—Menu	Off	
5—MRI Running Checks	Off	
6—MRI Checks Complete	Pulsing (similar to sleep)*	

***Note**: *As of AST 1.2.3, once MRI checks are complete on a Mac notebook, MRI turns the keyboard backlight on and off in sync with the SIL (approximately every two seconds) to verify keyboard backlight functionality. MRI does this indefinitely until the UUT is shut down or restarted.*

NAD Sleep Indicator Light Behavior

NAD Phase	SIL Behavior	SIL Example
1—Startup Chime	On	
2—NetBoot	Off	
3—Permission Dialog	Pulsing (similar to sleep)	
4—Menu	Off	
5—NAD Running Checks	Off	
6—NAD Checks Complete	Off	

Note: Some Macs, such as the MacBook Air (Late 2010), do not have a sleep indicator light.

AST Keyboard Operation

Many AST diagnostics such as MRI or NAD support the following keyboard shortcuts, so that a mouse or trackpad is not required:

S	Shuts down the NetBooted UUT, and disconnects the DG's connection to the UUT.
R	Restarts UUT.
1-9 0	Open up the first (top, left) though 10th ("0") configuration window; jumps to this window, if a configuration window already open.
shift-1-9 0	Open up the 11th (top, left) though 20th ("0") configuration window; jumps to this window, if a configuration window already open.
N	Reboots to the same NetBoot server.
▶	A module icon's MRI configuration window must be open for this key command to work. It moves to the next icon's configuration window; at the end of a row, it moves to the first (left-most) icon window of the next row. From the bottom, right-most icon window, it moves to the first (top, left-most) icon window.
◀	Exactly as above with the right arrow, but in reverse, moving backward to the left. A module icon's MRI configuration window must be open for this key command to work.
▲	Moves to the previous row of the same column. If on the first row, moves to the last row. If on a column with only one row, then mimics the right arrow's functionality. An icon's MRI configuration window must be open for this key command to work.
▼	Exactly as above, but in reverse, moving downward row to row within a column. If on a column with only one row, then mimics the left arrow's functionality. An icon's MRI configuration window must be open for this key command to work.

Using Gateway Manager to Access UUT Logs

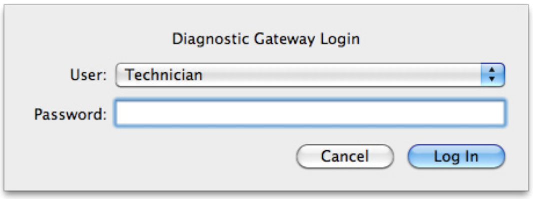
The DG Mac stores diagnostic log files for all UUTs at private/var/adg/. See the end of this section for more information about the location and meaning of folders in this subdirectory. These log files can be accessed directly, or by using the Gateway Manager application from any Mac running OS X v10.6 or later (client or server version) connected to the same subnet as the DG Mac. Gateway Manager does not need to be run from the DG Mac.

Note: Gateway Manager and AST versions are tied together, so make sure you are using latest version of each to ensure they work properly together.

1. Launch Gateway Manager (located in /Applications).

2. Technicians normally log in as 'Technician.' Administrator access allows configuration of additional login settings, whereas Technician access does not. Either access level allows you to examine UUT logs.

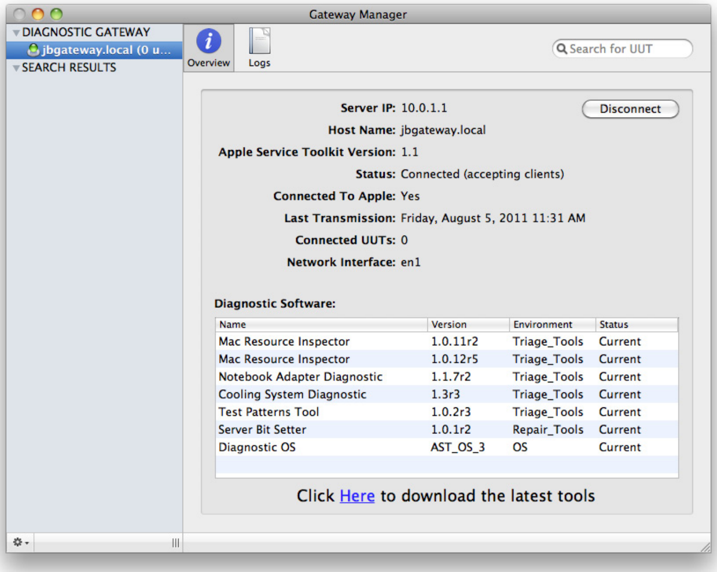
3. Select 'Technician' from the popup menu in the Gateway Login dialog, then enter the site-specific password for Gateway Manager and click 'Log In' or press Return/Enter. This password is configured in the 'settings' tab in Gateway Manager, which is available only to those with Administrator access.



User: Technician

Password:

4. In the left pane of the Gateway Manager window, select the name of the DG to examine, and the Overview tab displays information about that DG and the diagnostics it is hosting.



Server IP: 10.0.1.1

Host Name: jbgateway.local

Apple Service Toolkit Version: 1.1

Status: Connected (accepting clients)

Connected To Apple: Yes

Last Transmission: Friday, August 5, 2011 11:31 AM

Connected UUTs: 0

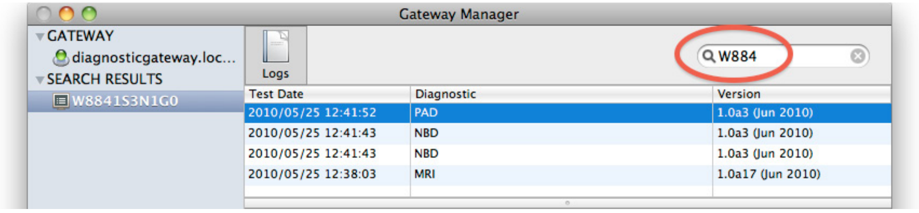
Network Interface: en1

Diagnostic Software:

Name	Version	Environment	Status
Mac Resource Inspector	1.0.11r2	Triage_Tools	Current
Mac Resource Inspector	1.0.12r5	Triage_Tools	Current
Notebook Adapter Diagnostic	1.1.7r2	Triage_Tools	Current
Cooling System Diagnostic	1.3r3	Triage_Tools	Current
Test Patterns Tool	1.0.2r3	Triage_Tools	Current
Server Bit Setter	1.0.1r2	Repair_Tools	Current
Diagnostic OS	AST_OS_3	OS	Current

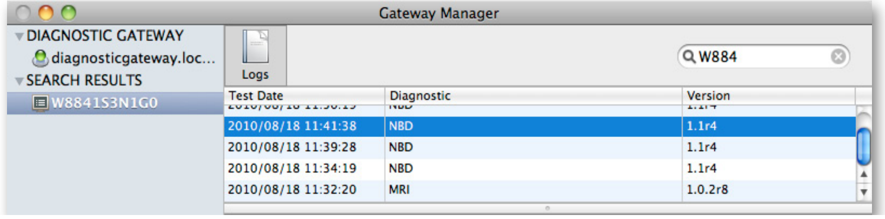
Click Here to download the latest tools

5. Search for the logs of a specific UUT by entering the first few characters of its serial number in the 'Search for UUT' box in the upper-right corner of the Gateway Manager window. A list of all UUTs that match those characters appears in the left pane.



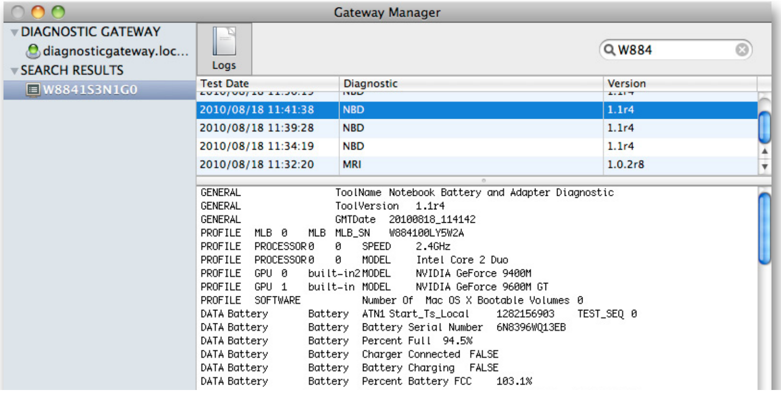
Test Date	Diagnostic	Version
2010/05/25 12:41:52	PAD	1.0a3 (Jun 2010)
2010/05/25 12:41:43	NBD	1.0a3 (Jun 2010)
2010/05/25 12:41:43	NBD	1.0a3 (Jun 2010)
2010/05/25 12:38:03	MRI	1.0a17 (Jun 2010)

6. Click to select a particular serial entry from the left pane to see a list of all UUT logs that were filed by AST diagnostics such as MRI and NAD. NAD logs are denoted as 'NBD.'



Test Date	Diagnostic	Version
2010/08/18 11:41:38	NBD	1.1r4
2010/08/18 11:39:28	NBD	1.1r4
2010/08/18 11:34:19	NBD	1.1r4
2010/08/18 11:32:20	MRI	1.0.2r8

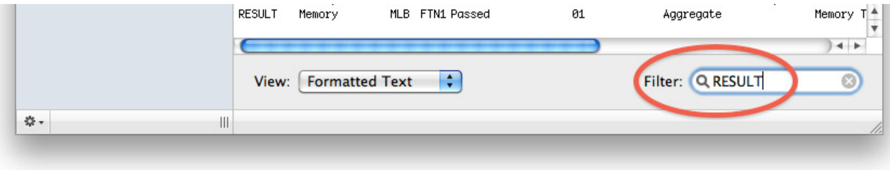
7. Select a particular log entry to examine it in more detail. The log detail appears in the window pane below the list. You can view the raw log file, or click the 'View' popup menu to select a formatted version that may be easier to read.



Test Date	Diagnostic	Version
2010/08/18 11:41:38	NBD	1.1r4
2010/08/18 11:39:28	NBD	1.1r4
2010/08/18 11:34:19	NBD	1.1r4
2010/08/18 11:32:20	MRI	1.0.2r8

```
GENERAL                 ToolName  Notebook Battery and Adapter Diagnostic
GENERAL                 ToolVersion   1.1r4
GENERAL                 GMTDate   20100818_114142
PROFILE   MLB  0    MLB  MLB_SN    W884100LY5W2A
PROFILE   PROCESSOR0    0    SPEED     2.4GHz
PROFILE   PROCESSOR0    0    MODEL     Intel Core 2 Duo
PROFILE   GPU  0    built-in2MODEL     NVIDIA GeForce 9400M
PROFILE   GPU  1    built-in MODEL     NVIDIA GeForce 9600M GT
PROFILE   SOFTWARE            Number Of  Mac OS X Bootable Volumes 0
DATA Battery        Battery   ATN1 Start_Ts_Local     1282156903    TEST_SEQ 0
DATA Battery        Battery   Battery Serial Number   6N8396WQ13EB
DATA Battery        Battery   Percent Full   94.5%
DATA Battery        Battery   Charger Connected  FALSE
DATA Battery        Battery   Battery Charging   FALSE
DATA Battery        Battery   Percent Battery FCC     103.1%
```

8. You can filter log results by test or by result using the filter search box in the lower right corner of the Gateway Manager window. In the example below, the search term 'RESULT' is used to locate and display all check result entries from every MRI check in the UUT log.



```
RESULT   Memory        MLB  FTN1 Passed            01            Aggregate            Memory  T
```

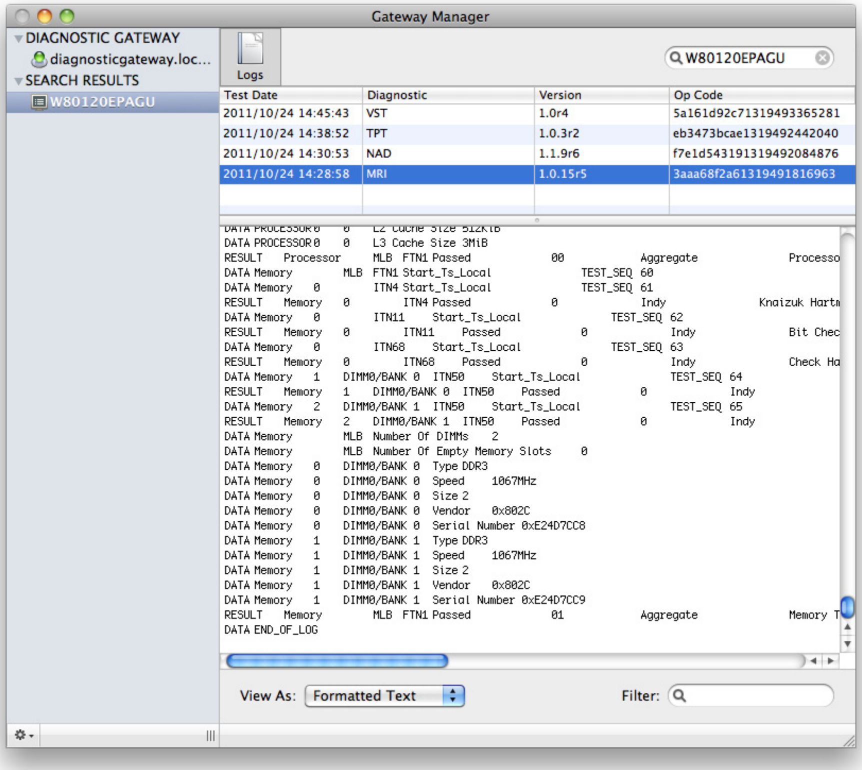
View: Formatted Text

Filter: RESULT

9. Refer to the section Detailed Description of All MRI Checks for thorough descriptions of all MRI checks and results, and how to interpret these results, to assist you during triage.

Op Codes

Gateway Manager now includes an "Op Code" column in the UUT log results list, containing the ADR transaction opcode (e.g., "f05f4734231315606450448"), if it exists.



Test Date	Diagnostic	Version	Op Code
2011/10/24 14:45:43	VST	1.0r4	5a161d92c71319493365281
2011/10/24 14:38:52	TPT	1.0.3r2	eb3473bcae1319492442040
2011/10/24 14:30:53	NAD	1.1.9r6	f7e1d543191319492084876
2011/10/24 14:28:58	MRI	1.0.15r5	3aaa68f2a61319491816963

```
DATA PROCESSOR 0    0    L2 Cache Size 512KiB
DATA PROCESSOR 0    0    L3 Cache Size 3MiB
RESULT    Processor      MLB  FTN1 Passed              00              Aggregate            Processo
DATA Memory         MLB  FTN1 Start_Ts_Local                TEST_SEQ  60
DATA Memory    0         ITN4 Start_Ts_Local                TEST_SEQ  61
RESULT    Memory    0         ITN4 Passed              0               Indy            Knaizuk Hartm
DATA Memory    0         ITN11     Start_Ts_Local                TEST_SEQ  62
RESULT    Memory    0         ITN11     Passed              0               Indy            Bit Chec
DATA Memory    0         ITN68     Start_Ts_Local                TEST_SEQ  63
RESULT    Memory    0         ITN68     Passed              0               Indy            Check Ha
DATA Memory    1    DIMM0/BANK 0  ITN50     Start_Ts_Local                TEST_SEQ  64
RESULT    Memory    1    DIMM0/BANK 0  ITN50     Passed              0               Indy
DATA Memory    2    DIMM0/BANK 1  ITN50     Start_Ts_Local                TEST_SEQ  65
RESULT    Memory    2    DIMM0/BANK 1  ITN50     Passed              0               Indy
DATA Memory         MLB  Number Of DIMMs    2
DATA Memory         MLB  Number Of Empty Memory Slots    0
DATA Memory    0    DIMM0/BANK 0  Type DDR3
DATA Memory    0    DIMM0/BANK 0  Speed     1067MHz
DATA Memory    0    DIMM0/BANK 0  Size 2
DATA Memory    0    DIMM0/BANK 0  Vendor    0x802C
DATA Memory    0    DIMM0/BANK 0  Serial Number 0xE24D7CC8
DATA Memory    1    DIMM0/BANK 1  Type DDR3
DATA Memory    1    DIMM0/BANK 1  Speed     1067MHz
DATA Memory    1    DIMM0/BANK 1  Size 2
DATA Memory    1    DIMM0/BANK 1  Vendor    0x802C
DATA Memory    1    DIMM0/BANK 1  Serial Number 0xE24D7CC9
RESULT    Memory         MLB  FTN1 Passed              01              Aggregate            Memory T
DATA END_OF_LOG
```

Each op code is a verification code that uniquely identifies each diagnostic event for every UUT. It can also provide verification that the ADR received this diagnostic event log result.

- Gateway Manager will display "none" if the Gateway Controller cannot determine the op code.
- Gateway Manager will display "Not Available" if the Gateway Controller does not provide the information (e.g., if Gateway Manager is connected to a server running a version of AST older than 1.2).

Folders Inside /var/adg/

On the DG Mac, AST caches the diagnostic test result log files it generates inside specific folders within /var/adg/. The meaning and purpose of each of these folders is described below.

/transactions/

AST test result log files for each UUT and test run (known as a 'diagnostic event') are initially saved to the /transactions/ folder, and remain there until one of two things happens:

1. They are sent to Apple's Diagnostic Repository (ADR), in which case files are automatically moved from this folder to the /processed/ folder as soon as the particular AST diagnostic completes and file transmission is complete. Most AST diagnostic tests usually take only a few minutes to complete. The /processed/ folder is described further below.

   or

2. A problem arises that disrupts the Gateway's normal logging operations, or the normal flow of result log files to the ADR, in which case the remaining result log file components will be moved to the /orphans/ folder, which is described further below.

Under normal circumstances, no files should ever reside inside the /transactions/ folder for longer than a few minutes after diagnostic tests are run.

/processed/

Once AST test result log files have been transmitted to the ADR they are moved to the /processed/ folder. They persist inside this folder for 7 days after the date they were transmitted. An automated process deletes files inside this folder that are older than a week.

Under normal circumstances, no files should ever reside inside the /processed/ folder for longer than a week after diagnostic tests are run.

/orphans/

Under normal circumstances, no files should ever reside inside this folder.

If anything causes AST to disrupt its normal logging operations, or the normal flow of result log files to the ADR as described above is disrupted, the remaining result log file components will be moved to the /orphans/ folder.

After three days the rest of the files associated with that diagnostic test will be moved to the /orphans/ folder. Therefore the files in the orphans folder have been disassociated from their diagnostic test event and were never sent to the ADR.

The orphans folder is primarily needed only for debugging and identifying problems. If you see files in the /orphans/ folder, check your settings in Gateway Manager to ensure your DG Mac is authenticating properly to the ADR.

Detailed Description of All MRI Checks

This section describes the meaning of all MRI checks, check codes, failure codes, result codes, expected configuration and check results displays, and troubleshooting tips.

Each MRI check is represented by an icon. The checks are executed in a 'top-left to bottom-right' order. The following pages describe each MRI check icon, in the same order in which the check is executed on the UUT. All checks are executed on all Macs, except where noted.

Each icon has at least one aggregate check result. In addition, some icons, such as logic board, memory, and AirPort checks, have more than a single 'presence' check. In those cases, the individual checks are listed and described, along with the aggregate check result.

The green, yellow, and red badges on each MRI icon represent the status of each check's results. MRI also automatically enters information into its log file for each check. Viewing and interpreting log information can be useful when troubleshooting UUTs with "no video" issues.

IMPORTANT: Do not imply to the customer that a module or component requires replacement just because its MRI check icon displays a yellow or red badge.

Always follow up with more thorough troubleshooting steps using the UUT's latest Apple Technician Guide before replacing any parts.

The order in which MRI executes its hardware checks is as follows:

Note: MRI runs its longest checks (sensors, processors, and memory) last, so that the initial check results can be shown quickly. This can help the tech to continue probing the customer's issue with the customer, while MRI continues and completes its checks:

Portable Macs

1. Logic Board
2. SD Board presence
3. Bluetooth presence
4. AirPort presence
5. Internal display presence
6. Camera presence
7. Apple USB Input Devices presence
8. Optical drive presence
9. Ethernet
10. Battery
11. Adapter
12. Hard drive
13. Fan (motor)
14. GPU presence
15. Sensors
16. Processors
17. Memory

Desktop Macs:

1. Logic Board
2. SD Board presence
3. Bluetooth presence
4. AirPort presence
5. Internal display presence
6. Camera presence
7. Apple USB Input Devices presence
8. Optical drive presence
9. Ethernet
10. Hard drive
11. Power supply presence
12. Fan (motor)
13. GPU presence
14. Sensors
15. Processors
16. Memory

Logic Board (MLB)

The logic board module contains a series of checks for its BootROM and SMC. This module also includes SD Board checks in portables

Description: These checks verify that the BootROM and the SMC are functioning properly.

Supported hardware: All Macs

Check Name
Boot ROM Checksum Test
Boot ROM FireWire GUID MAC Address Checksum Test[1]
Boot ROM Headers and Data Checksum Test
SMC PID Sensor check[2]
SMC EPM check

[1] *This check is run only on Macs with FireWire.*

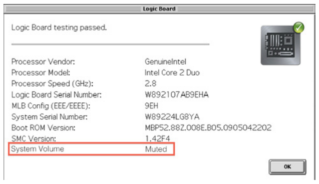
[2] *This check is not run on Mac portables.*

MRI Icon	Description
✓	All logic board checks passed.
⚠	The SMC is in an indeterminate state because PRAM or NVRAM was reset before running MRI (i.e., not yet booted into OS X). Restart the UUT into OS X once to properly initialize the SMC; then run MRI again to remove the yellow caution indicator.
❗	One or more individual logic board checks failed.

Troubleshooting Tips

Check connections to logic board and retest. Also, examine other MRI icons to see if they report a failed (red) status; the failures may indicate a more serious issue common to all the affected modules. For example, a disconnected sensor cable may cause failures with logic board SMC checks as well as sensor and fan speed failures.

MRI logic board check shows the computer's audio volume setting ('muted,' 'low,' or 'active'), which helps to troubleshoot issues where the sound may simply be set too low to be heard.



Logic Board testing passed.

Processor Vendor:	GenuineIntel
Processor Model:	Intel Core 2 Duo
Processor Speed (GHz):	2.8
Logic Board Serial Number:	W892107AB9EHA
MLB Config (EEE/EEEE):	9EH
System Serial Number:	W89224LG8YA
Boot ROM Version:	MBP52.88Z.008E.B05.0905042202
SMC Version:	1.42F4
System Volume	Muted

Logic board window with System Volume result

Note: MRI displays the UUT's main system volume only, not peripheral volume settings. OS X stores multiple independent volume settings, depending on what is connected to the computer (headphones, etc.). For example, in a computer connected to an external Apple display with built-in speakers, the volume setting you see in the Finder's menu bar and System Preferences controls the display's speakers, not the main system volume. MRI reports the main system volume only.

SD Board

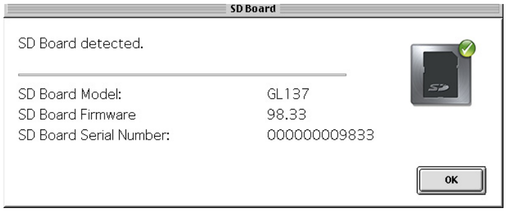
The SD board module check is separate on computers with separate SD boards, such as iMacs. It is included with the logic board tests for portables.

Description: Checks for the presence of the SD board, for Macs that should have it.

Supported hardware: When the SD board is a separate module, such as in iMacs, this presence test is run as part of the separate "SD Board" test module as listed here. When the SD board is soldered on, such as in recent MacBooks and MacBook Pro models, this presence test is run as part of the "Logic Board" module listed above, not as a separate test module.

Check Name
SD board presence check

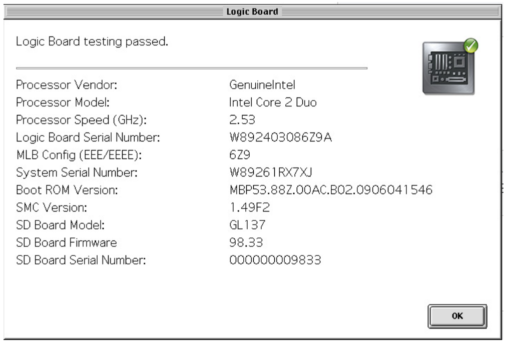
MRI Icon	Description
SD ✓	SD board detected
SD !	SD board not detected



SD Board detected.

SD Board Model: GL137
SD Board Firmware 98.33
SD Board Serial Number: 000000009833

SD board result window



Logic Board testing passed.

Processor Vendor: GenuineIntel
Processor Model: Intel Core 2 Duo
Processor Speed (GHz): 2.53
Logic Board Serial Number: W892403086Z9A
MLB Config (EEE/EEEE): 6Z9
System Serial Number: W89261RX7XJ
Boot ROM Version: MBP53.88Z.00AC.B02.0906041546
SMC Version: 1.49F2
SD Board Model: GL137
SD Board Firmware 98.33
SD Board Serial Number: 000000009833

Logic board result window without an SD board

MRI Log Examples - Logic Board & SD Board

```
DATA Logic Board MLB FTN1 Start_Ts_Local
1291661511 TEST_SEQ 0

DATA BootROM 0 ITN1 Start_Ts_Local 1291661511
TEST_SEQ 1

RESULT BootROM 0 ITN1 Passed 0 Indy Boot ROM
Checksum Test End_Ts_Local 1291661511 TEST_SEQ
1 Elapsed_seconds 0

DATA BootROM 0 ITN2 Start_Ts_Local 1291661511
TEST_SEQ 2

RESULT BootROM 0 ITN2 Passed 0 Indy Boot ROM
FW GUID MAC Addr Checksum Test End_Ts_Local
1291661511 TEST_SEQ 2 Elapsed_seconds 0

DATA SMC 0 ITN7 Start_Ts_Local 1291661511 TEST_
SEQ 3

RESULT SMC 0 ITN7 Passed 0 Indy SMC EPM check
End_Ts_Local 1291661511 TEST_SEQ 3 Elapsed_
seconds 0

DATA Logic Board MLB System Volume Muted

DATA Logic Board MLB Server Bit 0

DATA Logic Board MLB AppleCare Name Mac mini
(Mid 2010)

DATA Logic Board MLB MLB Config DC6Y

DATA Logic Board MLB System Serial Number
C07DQ012DD6L

DATA Logic Board MLB Boot ROM Version
MM41.88Z.0042.B00.1004221740

DATA Logic Board MLB SMC Version 1.65f2

DATA Logic Board MLB Macintosh Model Macmini4,1

DATA Logic Board MLB Macintosh Board-ID Mac-
F2208EC8

DATA Logic Board MLB Processor Vendor
GenuineIntel

DATA Logic Board MLB Processor Model Intel Core
2 Duo

DATA Logic Board MLB Speed 2.66GHz

DATA Logic Board 3 chipSet Vendor 0x10DE

DATA Logic Board 3 chipSet Revision ID 0xA2

DATA Logic Board 3 chipSet Name Nvidia_MCP89

DATA Logic Board 3 chipSet Version 0.9625 V

DATA SD Board 0 MLB Model CaesarIV SDXC Reader

DATA SD Board 0 MLB Firmware Version

DATA SD Board 0 MLB Serial Number

DATA SD Board MLB ATN1 Start_Ts_Local
1291661511 TEST_SEQ 4

DATA SD Board 0 Card Model CaesarIV SDXC Reader

DATA SD Board 0 Card Firmware Version

DATA SD Board 0 Card Serial Number

RESULT SD Board MLB ATN1 Passed 00 App SD
Board Presence SD Board detected. End_Ts_Local
1291661511 TEST_SEQ 4 Elapsed_seconds 0

RESULT Logic Board MLB FTN1 Passed 00 Aggregate
Logic Board Test End_Ts_Local 1291661511 TEST_
SEQ 0
```

Bluetooth

Description: Checks for the presence of Bluetooth in Macs that should have it.

Supported hardware: Macs that support Bluetooth

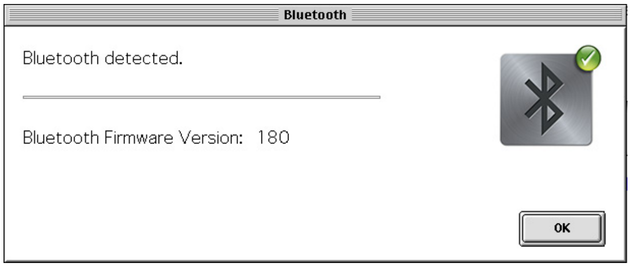
Check Name
Bluetooth presence check

MRI Icon	Description
✓	Bluetooth module detected
⚠	Bluetooth module not detected, but hardware optional
!	Bluetooth module not detected

Troubleshooting Tips

Check connections to the Bluetooth board and retest. Verify if Bluetooth is expected for this configuration. If Bluetooth is not expected, you can safely ignore the yellow caution. Remember that yellow does not necessarily mean failure; it simply lets the tech know to investigate further.

MRI cannot detect the presence of antennas connected to the AirPort and Bluetooth modules.



Bluetooth detected.

Bluetooth Firmware Version: 180

Bluetooth result window

MRI Log Examples - Bluetooth

```
DATA Bluetooth MLB Firmware Version 1.80

RESULT Bluetooth MLB ATN1 Passed 00 App Bluetooth Presence Bluetooth detected.
```

AirPort

The AirPort check suite contains a presence test and a network presence test

Description: MRI first checks to see if it can detect the AirPort module. Then, on Macs that have an EFI AirPort network driver, MRI runs network check #5, ("Scan Test")

Supported hardware: All Macs that support AirPort. The network check and its associated failure are valid only on Macs that have EFI AirPort network drivers, such as MacBook Air.

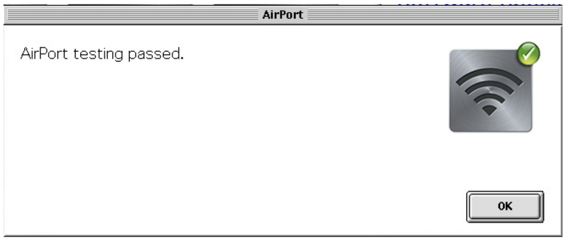
Check Name
AirPort presence check
PCI-E LinkWidth Verification Test

MRI Icon	Description
✓	AirPort module detected
⚠	AirPort module not detected, but hardware optional
❗	AirPort module not detected
❗	AirPort network failure

Troubleshooting Tips

Check connections to AirPort module and retest. Verify if AirPort is expected for this configuration. If AirPort is not expected, you can safely ignore the yellow caution. Remember that yellow does not necessarily mean failure; it simply lets the tech know to investigate further.

MRI cannot detect the presence of antennas connected to the AirPort and Bluetooth modules.



AirPort testing passed.

AirPort result window

MRI Log Examples - AirPort

```
RESULT AirPort 0 ITN1 Passed 0 Indy PCI-E LinkWidth Verification Test
RESULT AirPort FTN1 Passed 00 Aggregate AirPort Test
```

Display

Description: Checks for the presence of built-in displays on all iMacs and portables.

New: MRI now reports if a string of LEDs is defective in the display backlight of MacBook Pro (Early 2011) computers (only).

Supported hardware: All iMacs and portables for presence check. MacBook Pro (Early 2011) computers for backlight status check.

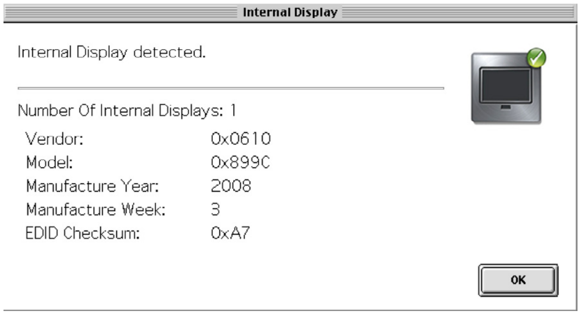
Check Name
Display presence check

MRI Icon	Description
✓	Display detected
!	Display not detected

Troubleshooting Tips

MRI will always use the internal display if detected (i.e. if connected), even if an external display is also connected. If MRI cannot detect an internal display, and an external display is also connected, then MRI will use the external display as its primary (and only supported) display.

- Check connections to display and retest.
- Replace display module and retest.



Internal Display detected.

Number Of Internal Displays: 1

Vendor:	0x0610
Model:	0x899C
Manufacture Year:	2008
Manufacture Week:	3
EDID Checksum:	0xA7

Display configuration window

MRI Log Examples - Display

```
DATA Displays LCD Number Of Internal
Displays 1

DATA Displays LCD Width x Height 1920

DATA Displays 0 LCD Vendor 0x0610

DATA Displays 0 LCD Model 0x999C

DATA Displays 0 LCD Manufacture Year 2009

DATA Displays 0 LCD Manufacture Week 1

DATA Displays 0 LCD EDID Checksum 0xB7

RESULT Display ATN1 Passed 00 App Display
Presence
```

Camera

Description: Checks for the presence of the built-in iSight camera, on some Mac models.

Note: Currently, MRI can detect camera hardware on only a few Mac models. On unsupported models, the camera check will not run and no camera icon will appear.

Check Name
Camera module presence check

MRI Icon	Description
📷 ✓	Camera detected
📷 !	Camera not detected

Troubleshooting Tips

Check connections to camera module and retest. Replace camera module and retest.

MRI Log Examples - Camera

```
DATA Camera Result Unit_String a:00
```

Apple USB Input Devices

Description: MRI shows all attached Apple keyboards, mice, and trackpads, and checks for the presence of a trackpad, trackpad button, and keyboard on portables.

Supported hardware: All Macs. Checks for trackpad and trackpad buttons on portables only.

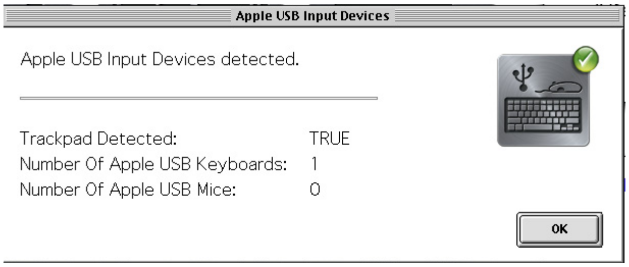
Note: For Unibody MacBook and MacBook Pro, the USB Input Device Controller is part of the logic board, while on previous MacBook and MacBook Pro models, the USB Input Device Controller is part of the top case.

Check Name
USB input device presence check

MRI Icon	Description
✓	USB input device(s) detected
❗	USB input device(s) not detected

Troubleshooting Tips

Check the trackpad, internal keyboard, top case or external USB input device(s) connections and retest.



Apple USB Input Devices detected.

Trackpad Detected: TRUE
Number Of Apple USB Keyboards: 1
Number Of Apple USB Mice: 0

USB input device configuration window

MRI Log Examples - USB Input Devices

```
DATA Apple USB Input Devices MLB Trackpad Detected YES

DATA Apple USB Input Devices Number Of Keyboards 1

DATA Apple USB Input Devices Number Of Mice 0

RESULT Apple USB Input Devices ATN1 Passed 00 App Apple USB Input Devices Presence
```

Optical Drives

Description: Detects all optical drives on a system; fails if it does not find expected device(s).

Notes:

- This check is not run on MacBook Air.
- On a some models of Mac mini, such as the Mac mini (Late 2009), this check displays a yellow badge if it finds no optical drive and two hard drives: this is assumed to be a Mac mini Server configuration.
- On Mac Pros, this check displays a yellow badge, because Mac Pros may not have optical drives (they ship with at least one, but users can easily remove them).

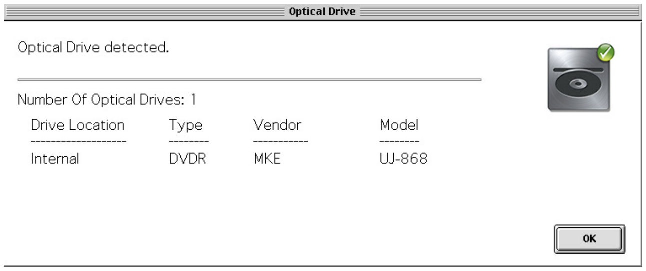
Supported hardware: All Macs with optical drives. Not supported on MacBook Air.

Check Name
Optical drive presence check

MRI Icon	Description
✓	Optical drive(s) detected
⚠	Optical drive(s) not detected, but hardware optional
⚠	No optical drive and two hard drives detected on a Mac mini Server
!	Optical drive(s) not detected, but hardware optional

Troubleshooting Tips

Check connections to optical drive(s) and re-test.



```
Optical Drive detected.

Number Of Optical Drives: 1
  Drive Location      Type     Vendor       Model
  ------------------  -------- -----------  --------
  Internal            DVDR     MKE          UJ-868
```

Optical drive configuration window

MRI Log Examples - Optical Drives

```
DATA Optical Drives MLB NumberOfOpticalDrives 1

DATA Optical Drive 0 Internal Type DVDR

DATA Optical Drive 0 Internal Serial Number dE166DBF

DATA Optical Drive 0 Internal Model UJ-868

DATA Optical Drive 0 Internal Vendor MKE

RESULT Optical Drive ATN1 Passed 00 App Optical Drive Presence
```

Ethernet

Description: Checks the Ethernet Controller hardware, except on MacBook Air. Mac Pro computers typically have two Ethernet Controllers, while all other non-MacBook Air systems have one. The configuration detail window also displays the IP address assigned to the UUT.

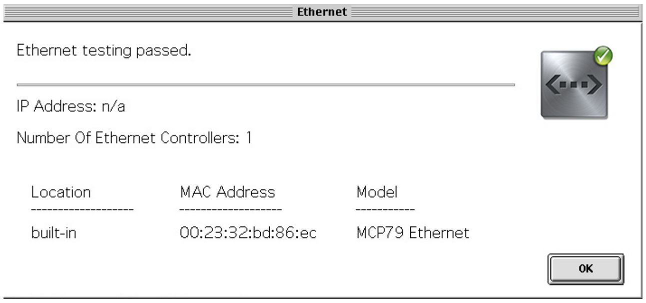
Supported hardware: All Macs with Ethernet. Not supported on MacBook Air.

Check Name
Ethernet Controller check

MRI Icon	Description
✓	Ethernet Controller(s) detected
!	Ethernet Controller(s) not detected

Troubleshooting Tips

Check network connection to Ethernet port and retest. Check condition of Ethernet port and retest. Replace module containing Ethernet port (logic or backplane board) and retest.



Ethernet testing passed.

IP Address: n/a

Number Of Ethernet Controllers: 1

```
Location              MAC Address           Model
-------------------   -------------------   -----------
built-in              00:23:32:bd:86:ec     MCP79 Ethernet
```

Ethernet Controller configuration window

MRI Log Examples - Ethernet

```
RESULT EthernetController 0 built-in ITN1 Passed 0 Indy MAC Address Verification Test

DATA Ethernet MLB NumberOfEthernet Controllers 1

DATA Ethernet MLB IP Address n/a

DATA Ethernet 0 built-in MAC Address 00:25:bc:dd:e3:e0

DATA Ethernet 0 built-in Model MCP79 Ethernet

DATA Ethernet 0 built-in Vendor Nvidia Corporation

RESULT Ethernet Ethernet FTN1 Passed 00 Aggregate Ethernet Test
```

Battery (Portable Macs Only)

Description: Checks Mac portable main battery.

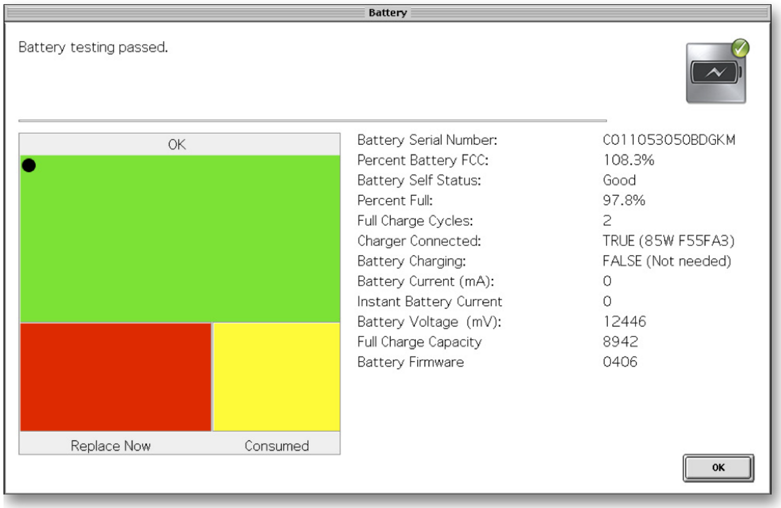
Supported hardware: All portable Macs. This check is not executed on desktop Macs.

Check Name
Aggregate result of all battery checks

MRI Icon	Description
✓	All battery tests pass
⚠ **SPECIAL CASE:** Read carefully & follow tips below.	If the battery icon has a yellow badge, this means the battery may have failed, but also may be consumed (the only situation where a failure is coded yellow). If the battery icon has a yellow badge, diminished performance of the battery is not covered under warranty or APP since may have been exceeded its charge cycle capacity (i.e., it has been consumed). Your customer may want to purchase a replacement battery to improve performance or minimize computer usage on battery power.
❗	Battery testing failed

Troubleshooting Tips

If the battery icon has a yellow or red badge, run the Notebook Adapter Diagnostic after running MRI. You can do this easily by restarting the UUT, then selecting this option from the menu.



Battery testing passed.

```
Battery Serial Number:        C011053050BDGKM
Percent Battery FCC:          108.3%
Battery Self Status:          Good
Percent Full:                 97.8%
Full Charge Cycles:           2
Charger Connected:            TRUE (85W F55FA3)
Battery Charging:             FALSE (Not needed)
Battery Current (mA):         0
Instant Battery Current       0
Battery Voltage  (mV):        12446
Full Charge Capacity          8942
Battery Firmware              0406
```

MRI Log Examples - Battery (portable Macs only)

```
DATA_BATTERY_0_Battery Found Battery found

RESULT Battery Battery ITN5 Passed 0 Indy RA Table Test

RESULT Battery Battery ATN1 Passed 00 App Battery Test
No problems found.

DATA Battery Battery Percent Full 99.2%

DATA Battery Battery Charger Connected TRUE (85W
7B0353)

DATA Battery Battery Charging FALSE (Not needed)

DATA Battery Battery Percent FCC 99%

DATA Battery Battery Self Status Good

DATA Battery Battery Full Charge Capacity 12598mA

DATA Battery Battery Capacity 12506mA

DATA Battery Battery Fully Charged TRUE

DATA Battery Battery Full Charge Cycles 4

DATA Battery Battery Design Cycle Count 1000

DATA Battery Battery Is Consumed FALSE

DATA Battery Battery Current 0mA

DATA Battery Battery Voltage 8333mV

DATA Battery Battery Is Charger Connected TRUE

DATA Battery Battery Is Charging FALSE

DATA Battery Battery Number of Cells 2

DATA Battery Battery Cell 1 voltage 4166mV

DATA Battery Battery Cell 2 voltage 4166mV

DATA Battery Battery Error Condition No Error

DATA Battery Battery Status Flag 0x40E0

DATA Battery Battery temp, sensor 1 28.296¬∞C

DATA Battery Battery temp, sensor 2 28.097¬∞C

DATA Battery Battery sleep-drain/hr n/a

DATA Battery Battery cell imbalance spec 15
```

```
DATA Battery PF Status 0x0000

DATA Battery Battery Instant Battery Current 0mA

DATA Battery Battery Serial Number 9G9230BJ64M0A

DATA Battery Battery Firmware Version 0042

DATA Battery Battery reserve 275

DATA Battery Battery manufacturer DP

DATA Battery Battery device name bq20z951

DATA Battery Battery SMART Battery Serial Number
DP-bq20z951-3AC

DATA Battery Battery Pack Serial Number 9G9230BJ64M0A

DATA Battery Battery #secs !chrge abs tmp n/a

DATA Battery Battery #secs !chrge grd tmp n/a

DATA Battery Battery #secs lmt chrge abs tmp n/a

DATA Battery Battery #secs lmt chrge grd tmp n/a

DATA Battery Battery #secs lmt chrge blv tmp n/a

DATA Battery Battery Hardware Revision 0001

DATA Battery Battery Cell Revision 0119

DATA Battery Battery Pack Lot Code 0000

DATA Battery Battery Is AC LED Controllable TRUE

DATA Battery Battery Manufacture Date 5-6-2009

DATA ADAPTER MLB Wattage 85W

DATA ADAPTER MLB Revision 0

DATA ADAPTER MLB Serial Number 7B0353

DATA ADAPTER MLB Family Code BA

DATA Adapter Wattage 85W

DATA Adapter Serial Number 7B0353

RESULT Adapter Adapter FTN1 Passed 00 Aggregate
Adapter Check
```

Power Adapter (Portable Macs Only)

Description: Shows Mac portable power adapter status. Analogous to the power supply test for desktops.

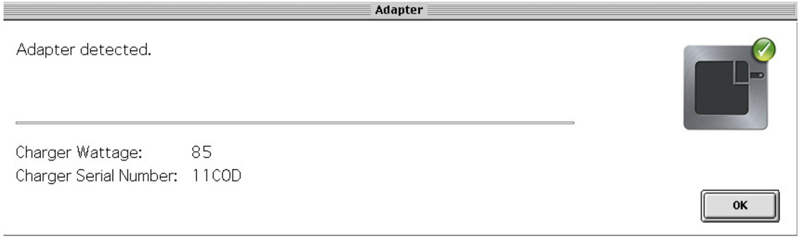
Supported hardware: All portable Macs. This check is not executed on desktop Macs.

Check Name
Aggregate result of all power adapter checks

MRI Icon	Description
✓	Adapter detected
⚠	Adapter not detected
❗	You should never see this status for the power adapter check. If you suspect power adapter issues then run NAD on this UUT.

Troubleshooting Tips

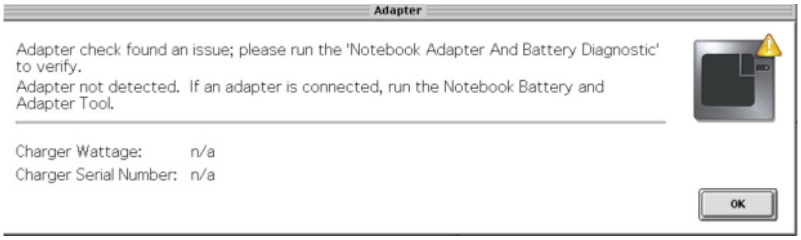
If a correctly-rated adapter is connected and the adapter icon has a yellow or red badge, run the Notebook Adapter Diagnostic after running MRI. You can easily do this by restarting the UUT, then selecting this option from the menu.



Adapter detected.

Charger Wattage: 85
Charger Serial Number: 11C0D

Power adapter configuration window with correct adapter detected



Adapter check found an issue; please run the 'Notebook Adapter And Battery Diagnostic' to verify.
Adapter not detected. If an adapter is connected, run the Notebook Battery and Adapter Tool.

Charger Wattage: n/a
Charger Serial Number: n/a

Power adapter configuration window with no adapter detected

MRI Log Examples - Power Adapter (portable Macs only)

```
DATA_BATTERY_0_Battery Found Battery found

RESULT Battery Battery ITN5 Passed 0 Indy RA Table Test

RESULT Battery Battery ATN1 Passed 00 App Battery Test
No problems found.

DATA Battery Battery Percent Full 99.2%

DATA Battery Battery Charger Connected TRUE (85W
7B0353)

DATA Battery Battery Charging FALSE (Not needed)

DATA Battery Battery Percent FCC 99%

DATA Battery Battery Self Status Good

DATA Battery Battery Full Charge Capacity 12598mA

DATA Battery Battery Capacity 12506mA

DATA Battery Battery Fully Charged TRUE

DATA Battery Battery Full Charge Cycles 4

DATA Battery Battery Design Cycle Count 1000

DATA Battery Battery Is Consumed FALSE

DATA Battery Battery Current 0mA

DATA Battery Battery Voltage 8333mV

DATA Battery Battery Is Charger Connected TRUE

DATA Battery Battery Is Charging FALSE

DATA Battery Battery Number of Cells 2

DATA Battery Battery Cell 1 voltage 4166mV

DATA Battery Battery Cell 2 voltage 4166mV

DATA Battery Battery Error Condition No Error

DATA Battery Battery Status Flag 0x40E0

DATA Battery Battery temp, sensor 1 28.296¬∞C

DATA Battery Battery temp, sensor 2 28.097¬∞C

DATA Battery Battery sleep-drain/hr n/a

DATA Battery Battery cell imbalance spec 15 DATA
Battery Battery PF Status 0x0000
```

```
DATA Battery Battery Instant Battery Current 0mA

DATA Battery Battery Serial Number 9G9230BJ64M0A

DATA Battery Battery Firmware Version 0042

DATA Battery Battery reserve 275

DATA Battery Battery manufacturer DP

DATA Battery Battery device name bq20z951

DATA Battery Battery SMART Battery Serial Number
DP-bq20z951-3AC

DATA Battery Battery Pack Serial Number 9G9230BJ64M0A

DATA Battery Battery #secs !chrge abs tmp n/a

DATA Battery Battery #secs !chrge grd tmp n/a

DATA Battery Battery #secs lmt chrge abs tmp n/a

DATA Battery Battery #secs lmt chrge grd tmp n/a

DATA Battery Battery #secs lmt chrge blv tmp n/a

DATA Battery Battery Hardware Revision 0001

DATA Battery Battery Cell Revision 0119

DATA Battery Battery Pack Lot Code 0000

DATA Battery Battery Is AC LED Controllable TRUE

DATA Battery Battery Manufacture Date 5-6-2009
```

```
DATA ADAPTER MLB Wattage 85W

DATA ADAPTER MLB Revision 0

DATA ADAPTER MLB Serial Number 7B0353

DATA ADAPTER MLB Family Code BA

DATA Adapter Wattage 85W

DATA Adapter Serial Number 7B0353

RESULT Adapter Adapter FTN1 Passed 00
Aggregate Adapter Check
```

Power adapter data is highlighted in the log example above.

Hard Drive

Description: Performs SMART status check on all detected internal hard drives (including SSD drives) that support SMART testing. In order to streamline diagnostic performance, MRI does not run any hard drive tests other than SMART. Upon failure, MRI marks the failed hard drive with a red box on the far left of the hard drive configuration window.

Supported hardware: All Macs that support SMART status.

Note: MRI cannot detect individual Mac Pro hard drives connected to a RAID card. MRI will display a warning (yellow) for the FTN1 HD test with the warning "SMART status cannot be tested on RAID controlled drives" warning code 10.

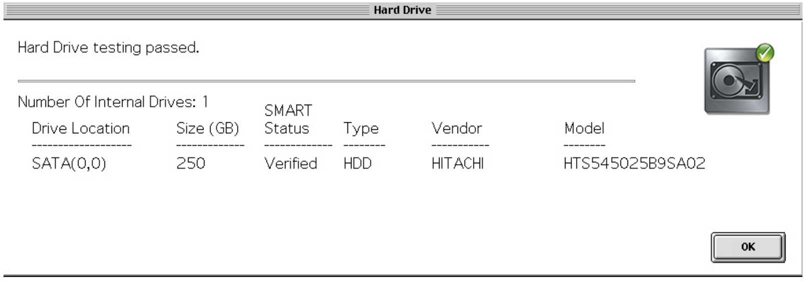
Check Name
Check SMART status

MRI Icon	Description
✓	Hard drive detected and SMART status check passed
⚠	SMART status cannot be tested on RAID controlled drives warning code 10.
!	SMART status check failed
!	Hard drive not detected

Troubleshooting Tips

If drive is not detected, check hard drive connections and retest. If issue persists, replace hard drive and retest.

If drive is present but fails the SMART test, replace drive and retest.



```
Hard Drive testing passed.

Number Of Internal Drives: 1
                                SMART
   Drive Location   Size (GB)   Status     Type    Vendor     Model
   --------------   ---------   --------   -----   --------   -----
   SATA(0,0)        250         Verified   HDD     HITACHI    HTS545025B9SA02
```

Hard drive configuration window

MRI Log Examples - Hard Drive

```
RESULT HardDrive 0 SATA(0,0) ITN30 Passed 0 Indy Check SMART status

DATA Hard Drives MLB NumberOfHardDrives 1

DATA Hard Drive 0 SATA(0,0) Model HTS545050B9SA02

DATA Hard Drive 0 SATA(0,0) Vendor HITACHI

DATA Hard Drive 0 SATA(0,0) Type HDD

DATA Hard Drive 0 SATA(0,0) Serial Number 090521PBC400Q7GPDSZA

DATA Hard Drive 0 SATA(0,0) Size 500MB

DATA Hard Drive 0 SATA(0,0) SMART Status Verified

RESULT Hard Drive Hard Drive FTN1 Passed 00 Aggregate Hard Drive Tests
```

Power Supply (Desktop Macs Only)

Description: Checks for the presence of the power supply in desktop Macs. Analogous to the battery / AC adapter tests for portables. MRI uses the word “present” instead of “detected” or “passed” to show that it makes no statement about the power supply’s functionality.

This check is not executed on portable Macs.

Note: MRI outputs no power supply information to the log.

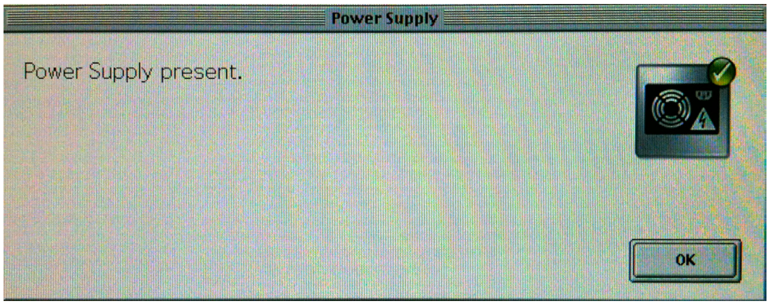
Supported hardware: All desktop Macs.

Check Name
Power supply presence check

MRI Icon	Description
✓	Power supply present
!	You should never see this status for power supply, because if the power supply was not working you would not be able to run MRI

Troubleshooting Tips

Troubleshoot as a ‘no power’ symptom using the latest Apple Technician Guide.



Power Supply present.

Power supply check results window

Fan (motors)

Description: Tests all internal fan motors. MRI also checks its configuration table to make sure that all fans that should be present, are actually present. On failure, MRI marks the fan that failed with a red box on the far left of the fan motor configuration window.

Supported hardware: All Macs.

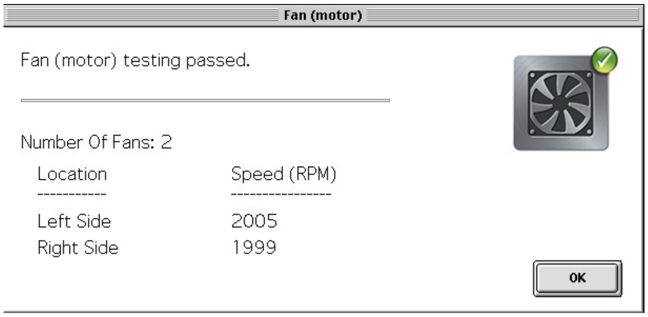
Check Name
Configuration Check
Quick Motor Test

MRI Icon	Description
✓	All fan motor checks passed
✓	Quick motor test passed
!	Fan checks failed (configuration failure)
!	Fan motor checks failed (speed or other failure)

Troubleshooting Tips

Check that fan blades are free from obstruction.

Also, examine other MRI icons to see if they too fail (red); the failures may be indicative of a more serious issue common to all affected modules. For example, a disconnected sensor cable may cause failures with logic board SMC checks,in addition to sensor and fan speed failures.



```
Fan (motor) testing passed.

Number Of Fans: 2
   Location            Speed (RPM)
   -----------         ----------------
   Left Side           2005
   Right Side          1999
```

Fan motor configuration window

MRI Log Examples - Fan (motors)

```
RESULT Fan MLB ATN1 Passed 1 App Fan Config Check

RESULT Motor 0 Left side ITN1 Passed 0 Indy Quick Motor Test

RESULT Motor 1 Right side ITN1 Passed 0 Indy Quick Motor Test

Number Of Fans: 2 Fan MLB NumberOfFans 2

DATA Fan 0 MLB Speed 1996RPM

DATA Fan 1 MLB Speed 2003RPM

RESULT Fan MLB FTN1 Passed 00 Aggregate Fan Tests
```

GPU (Video Controller)

Description: Detects the presence of all video controllers on a system; fails if it does not find any.

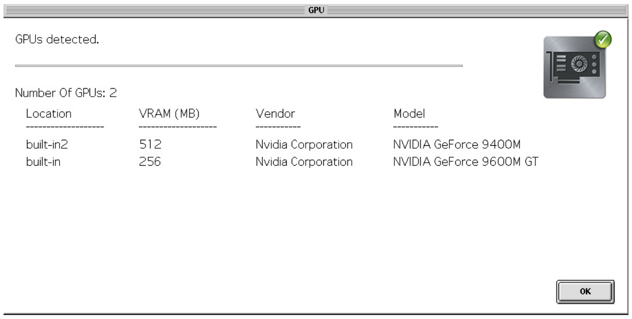
Supported hardware: All Macs.

Check Name
GPU presence check

MRI Icon	Description
✓	GPU(s) detected
!	GPU(s) not detected

Troubleshooting Tips

Check connections to GPU module and retest. Replace GPU module and retest.



```
GPUs detected.

Number Of GPUs: 2
   Location             VRAM (MB)            Vendor          Model
   -------------------  -------------------  -----------     -----------
   built-in2            512                  Nvidia Corporation   NVIDIA GeForce 9400M
   built-in             256                  Nvidia Corporation   NVIDIA GeForce 9600M GT
```

GPU configuration window

MRI Log Examples - GPU (video controller)

```
DATA GPU MLB NumberOfGPUs 2

DATA GPU 0 built-in2 VRAM 512MiB

DATA GPU 0 built-in2 Vendor Nvidia Corporation

DATA GPU 0 built-in2 Model NVIDIA GeForce 9400M

DATA GPU 1 built-in VRAM 256MiB

DATA GPU 1 built-in Vendor Nvidia Corporation

DATA GPU 1 built-in Model NVIDIA GeForce 9600M GT

RESULT GPU MLB ATN1 Passed 00 App GPU Presence GPUs detected.
```

Sensors

Description: Checks all internal sensors. MRI performs a series of tests to verify that each sensor reads within its normal operating range, for all current, voltage, power, and temperature sensors. MRI also checks its configuration table to make sure that all sensors that should be present are actually present.

Supported hardware: All Macs.

Check Name
Configuration Check
Sensor Reads Within Operating Range
Special Code Check
Over Temperature Test (for TH0o/hard drive proximity sensor)
ALS (Ambient Light Sensor Level)

MRI Icon	Description
✓	All sensors checks pass
✓	All sensors read within normal operating range
❗	No sensors found to test
❗	Individual sensor check failed (configuration failure)
❗	Individual sensor check failed (sensor out of range)
❗	Individual sensor check failed (other failure)
❗	ALS check failed (sensor disconnected)

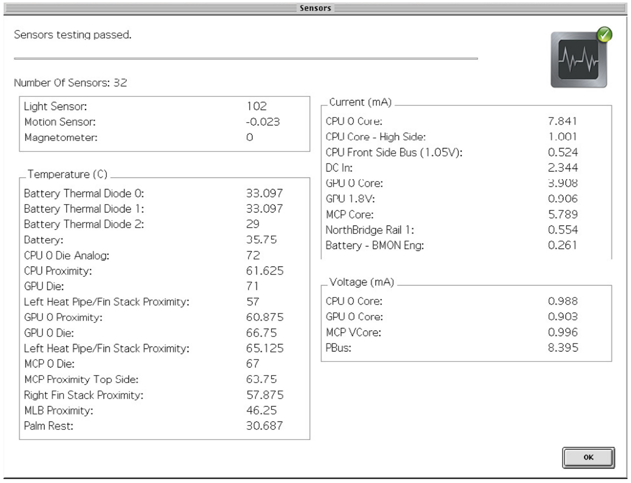
Notes:

- When the sensor configuration window is open, MRI updates all sensor readings every second.
- On failure, MRI marks the sensor that failed with a red box on the far left of the live sensor configuration window.
- MRI displays the Hard drive ("TH0O") and optical drive ("TH0o") proximity sensors as "misc" sensors, as they don't have temperature readings.

Troubleshooting Tips

Check connections to sensor(s) and retest.

Also, examine other MRI icons to see if they too fail (red); the failures may be indicative of a more serious issue common to all affected modules. For example, a disconnected sensor cable may cause failures with logic board SMC checks,in addition to sensor and fan speed failures.



Sensors testing passed.

Number Of Sensors: 32

Light Sensor:	102
Motion Sensor:	-0.023
Magnetometer:	0

Temperature (C)	
Battery Thermal Diode 0:	33.097
Battery Thermal Diode 1:	33.097
Battery Thermal Diode 2:	29
Battery:	35.75
CPU 0 Die Analog:	72
CPU Proximity:	61.625
GPU Die:	71
Left Heat Pipe/Fin Stack Proximity:	57
GPU 0 Proximity:	60.875
GPU 0 Die:	66.75
Left Heat Pipe/Fin Stack Proximity:	65.125
MCP 0 Die:	67
MCP Proximity Top Side:	63.75
Right Fin Stack Proximity:	57.875
MLB Proximity:	46.25
Palm Rest:	30.687

Current (mA)	
CPU 0 Core:	7.841
CPU Core - High Side:	1.001
CPU Front Side Bus (1.05V):	0.524
DC In:	2.344
GPU 0 Core:	3.908
GPU 1.8V:	0.906
MCP Core:	5.789
NorthBridge Rail 1:	0.554
Battery - BMON Eng:	0.261

Voltage (mA)	
CPU 0 Core:	0.988
GPU 0 Core:	0.903
MCP VCore:	0.996
PBus:	8.395

Sensor configuration window

Important: If a temperature sensor or fan is reported as failing by MRI, do not leave the system running, and shut it down as soon as possible, because excessive temperature may damage internal components. Then check that the affected sensor(s) or fan(s) are correctly connected, and that the fan(s), heatsink fin stack, and internal air flow are all free from dust or material obstruction before retesting the system again.

MRI Log Examples - Sensors

```
RESULT Sensor 0 IC0C ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 1 IC1C ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 2 IC2C ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 3 ID0R ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 4 IG0C ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 5 IG1C ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 6 IN0R ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 7 IN1R ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 8 IP0R ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 9 TB0T ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 10 TB1T ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 11 TB2T ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 12 TB3T ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 13 TC0D ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 14 TC0P ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 15 TG0D ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 16 TG0H ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 17 TG0P ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 18 TG0T ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 19 TG1H ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 20 TN0D ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 21 TN0P ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 22 Th2H ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 23 Tm0P ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 24 Ts0P ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 25 VC0C ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 26 VG0C ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 27 VN0R ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor 28 VP0R ITN1 Passed 0 Indy Sensor Reads
Within Operating Range

RESULT Sensor ALSL ATN1 Passed 0 App ALSL Sensor Test

DATA Sensor MLB NumberOfSensors 32

DATA Sensor MLB ALSL Passed 111 lux n/a Photometer
(ALSL) -- Light Sensor Photometer 0

DATA Sensor MLB MO_X Passed -0.023 n/a Accelerometer
(MO_X) -- Motion Sensor Accelerometer 0

DATA Sensor MLB MSLD Passed 0 n/a (MSLD) --
Magnetometer Magnetometer 0

DATA Sensor MLB TB0T Passed 28.296¬∞C n/a (TB0T) --
Battery Thermal Diode 0 Temperature 0

DATA Sensor MLB TB1T Passed 28.296¬∞C n/a (TB1T) --
Battery Thermal Diode 1 Temperature 0

DATA Sensor MLB TB2T Passed 28.097¬∞C n/a (TB2T) --
Battery Thermal Diode 2 Temperature 0

DATA Sensor MLB TB3T Passed 27.875¬∞C n/a (TB3T) --
Battery Temperature 0

DATA Sensor MLB TC0D Passed 46¬∞C n/a (TC0D) --
CPU 0 Die Analog Temperature 0

DATA Sensor MLB TC0P Passed 37.75¬∞C n/a (TC0P) --
CPU Proximity Temperature 0

DATA Sensor MLB TG0D Passed 47¬∞C n/a (TG0D) --
GPU Die Temperature 0

DATA Sensor MLB TG0H Passed 36.125¬∞C n/a (TG0H) --
Left Heat Pipe/Fin Stack Proximity Temperature 0

DATA Sensor MLB TG0P Passed 38.125¬∞C n/a (TG0P) --
GPU 0 Proximity Temperature 0

DATA Sensor MLB TG0T Passed 43¬∞C n/a (TG0T) --
GPU 0 Die Temperature 0

DATA Sensor MLB TG1H Passed 41¬∞C n/a (TG1H) --
Left Heat Pipe/Fin Stack Proximity Temperature 0

DATA Sensor MLB TN0D Passed 43.25¬∞C n/a (TN0D) --
MCP 0 Die Temperature 0

DATA Sensor MLB TN0P Passed 39.125¬∞C n/a (TN0P) --
MCP Proximity Top Side Temperature 0

DATA Sensor MLB Th2H Passed 35¬∞C n/a (Th2H) --
Right Fin Stack Proximity Temperature 0

DATA Sensor MLB Tm0P Passed 32.25¬∞C n/a (Tm0P) --
MLB Proximity Temperature 0

DATA Sensor MLB Ts0P Passed 27.75¬∞C n/a (Ts0P) --
Palm Rest Temperature 0

DATA Sensor MLB IC0C Passed 5.96mA n/a (IC0C) --
CPU 0 Core Current 0

DATA Sensor MLB IC1C Passed 0.735mA n/a (IC1C) --
CPU Core - High Side Current 0

DATA Sensor MLB IC2C Passed 0.504mA n/a (IC2C) --
CPU Front Side Bus (1.05V) Current 0

DATA Sensor MLB ID0R Passed 2.021mA n/a (ID0R) --
DC In Current 0

DATA Sensor MLB IG0C Passed 3.089mA n/a (IG0C) --
GPU 0 Core Current 0

DATA Sensor MLB IG1C Passed 0.764mA n/a (IG1C) --
GPU 1.8V Current 0

DATA Sensor MLB IN0R Passed 5.433mA n/a (IN0R) --
MCP Core Current 0

DATA Sensor MLB IN1R Passed 0.578mA n/a (IN1R) --
NorthBridge Rail 1 Current 0

DATA Sensor MLB IP0R Passed 0.261mA n/a (IP0R) --
Battery - BMON Eng Current 0

DATA Sensor MLB VC0C Passed 0.99mV n/a (VC0C) --
CPU 0 Core Voltage 0

DATA Sensor MLB VG0C Passed 0.903mV n/a (VG0C) --
GPU 0 Core Voltage 0

DATA Sensor MLB VN0R Passed 0.999mV n/a (VN0R) --
MCP VCore Voltage 0

DATA Sensor MLB VP0R Passed 8.401mV n/a (VP0R) --
PBus Voltage 0

RESULT Sensors MLB FTN1 Passed 00 Aggregate Sensor
Test
```

Processors

Description: Performs a functional check of all processors, including their L1 cache. Upon failure, MRI marks the failed processor with a red box on the far left of the processor configuration window.

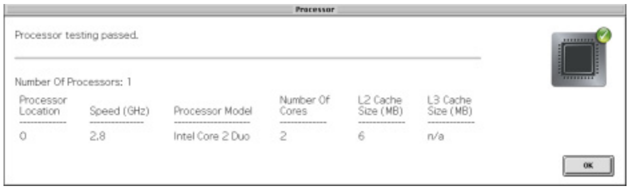
Supported hardware: All Macs.

Check Name
L1 Cache Test

MRI Icon	Description
✓	L1 cache test passed
!	No processors found to test
!	Individual processor check failed (other failure)

Troubleshooting Tips

Check connections to processor module and retest. Replace processor module and retest.



Processor testing passed.

Number Of Processors: 1

Processor Location	Speed (GHz)	Processor Model	Number Of Cores	L2 Cache Size (MB)	L3 Cache Size (MB)
0	2.8	Intel Core 2 Duo	2	6	n/a

Processor configuration window

MRI Log Examples - Processors

```
RESULT Processor 0 0 ITN1 Passed 0 Indy L1 Cache Test

DATA PROCESSOR MLB NumberOfProcessors 1

DATA PROCESSOR 0 0 Speed 2.8GHz

DATA PROCESSOR 0 0 Model Intel Core 2 Duo

DATA PROCESSOR 0 0 NumberOfCores 2

DATA PROCESSOR 0 0 L2 Cache Size 6MiB

DATA PROCESSOR 0 0 L3 Cache Size n/aMiB

RESULT Processor MLB FTN1 Passed 00 Aggregate Processor Test
```

Memory

Description: Tests all memory (RAM DIMMs). Reports when non-Apple memory is installed.

NOTE: Third-party memory is not replaced as part of a warranty repair and third-party memory cannot be sent to Apple as part of a repair.

These tests are the functional equivalent of AHT short memory tests. On failure, MRI marks the DIMM that failed with a red box on the far left of the memory configuration window. MRI is also aware of how many memory slots are in each UUT, and will display a count of empty slots in the memory configuration window, visible when the MRI memory test icon is opened.

Supported hardware: All Macs.

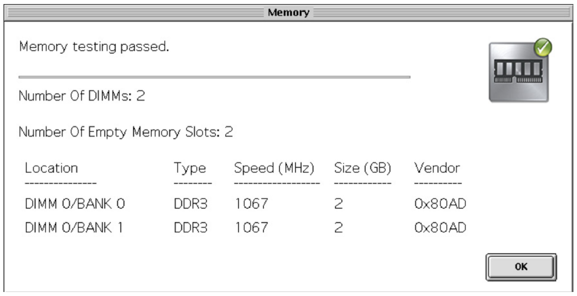
Check Name
Knaizuk Hartmann Test
MP Bit Checkerboard Test[1]
Check Hardware Errors Test[2]

[1] *This test is not run on Macs with 32-bit processors*

[2] *This test is only run on Macs with ECC memory, such as Mac Pro*

MRI Icon	Description
✓	All memory tests passed
⚠	Non-Apple memory DIMM installed
❗	Individual memory test failed

Double-click the memory icon to display detailed information, such as the number, location, type, speed, size and vendor of DIMMs, including both Apple-original and non-Apple RAM.

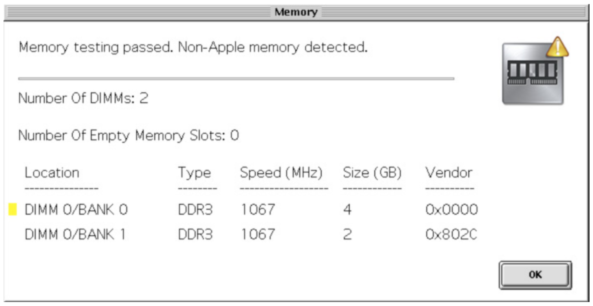


```
Memory testing passed.

Number Of DIMMs: 2

Number Of Empty Memory Slots: 2

Location          Type     Speed (MHz)    Size (GB)    Vendor
---------------   --------  ------------------  ------------  ---------
DIMM 0/BANK 0     DDR3     1067           2            0x80AD
DIMM 0/BANK 1     DDR3     1067           2            0x80AD
```

Memory configuration window

NEW!

AppleCare has added a new RAM test to MRI that identifies non-Apple memory in MacBook Pro portables, beginning with the MacBook Pro (Mid 2007) models.



```
Memory testing passed. Non-Apple memory detected.

Number Of DIMMs: 2

Number Of Empty Memory Slots: 0

  Location          Type    Speed (MHz)  Size (GB)  Vendor
  ---------------   ------  -----------  ---------  --------
▮ DIMM 0/BANK 0     DDR3    1067         4          0x0000
  DIMM 0/BANK 1     DDR3    1067         2          0x802C
```

Memory configuration window showing non-Apple memory

Why Use MRI to Identify Non-Apple Memory?

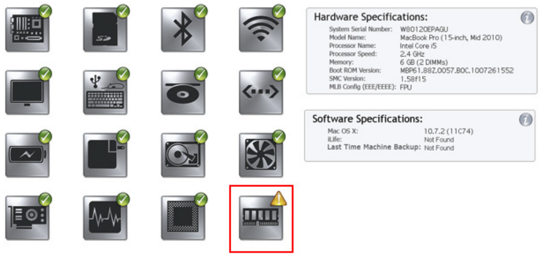
Many symptoms can be caused by non-Apple RAM, and it is important that technicians identify the presence of non-Apple RAM to:

1. Properly diagnose the issue.
2. Ensure that the RAM is not sent back to Apple for an Apple-qualified RAM replacement.

Because non-Apple RAM can cause different issues, including no startup, intermittent shut-down, or freezing, it is necessary to remove non-Apple RAM first to eliminate it as a potential cause.

Using MRI to Identify Non-Apple Memory

When MRI is run on a Mac, it will call out the presence of non-Apple RAM by displaying a yellow status on the memory icon.

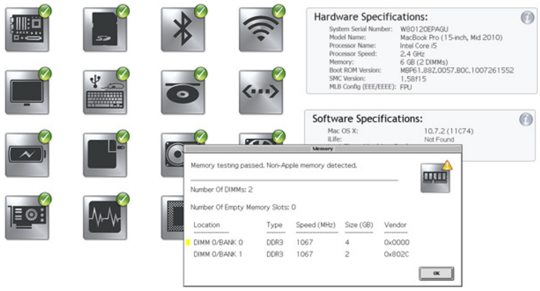

Hardware Specifications:

System Serial Number: W80120EPAGU
Model Name: MacBook Pro (15-inch, Mid 2010)
Processor Name: Intel Core i5
Processor Speed: 2.4 GHz
Memory: 6 GB (2 DIMMs)
Boot ROM Version: MBP61.88Z.0057.B0C.1007261552
SMC Version: 1.58f15
MLB Config (EEE/EEEE): FPU

Software Specifications:

Mac OS X: 10.7.2 (11C74)
iLife: Not Found
Last Time Machine Backup: Not Found

When you open the memory icon, a yellow bar next to the DIMM specification indicates a non-Apple RAM module and its exact memory bank location.


Hardware Specifications:

System Serial Number: W80120EPAGU
Model Name: MacBook Pro (15-inch, Mid 2010)
Processor Name: Intel Core i5
Processor Speed: 2.4 GHz
Memory: 6 GB (2 DIMMs)
Boot ROM Version: MBP61.88Z.0057.B0C.1007261552
SMC Version: 1.58f15
MLB Config (EEE/EEEE): FPU

Software Specifications:

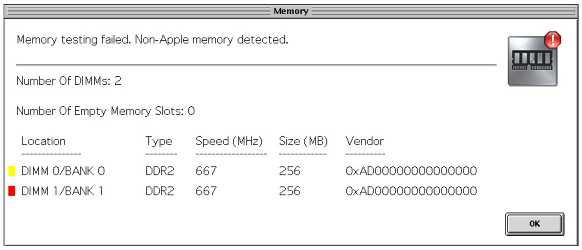
Mac OS X: 10.7.2 (11C74)
iLife: Not Found

```
Memory testing passed. Non-Apple memory detected.

Number Of DIMMs: 2

Number Of Empty Memory Slots: 0

  Location          Type    Speed (MHz)  Size (GB)  Vendor
  ---------------   ------  -----------  ---------  --------
▮ DIMM 0/BANK 0     DDR3    1067         4          0x0000
  DIMM 0/BANK 1     DDR3    1067         2          0x802C
```

In the event that some RAM does not pass testing, you will see one of the following screens.

Apple RAM does not pass, but non-Apple RAM does pass.

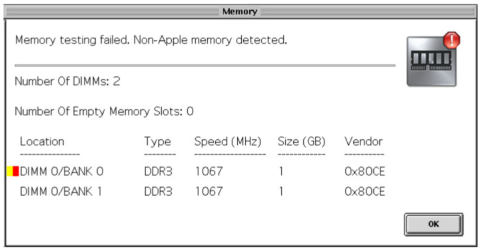
Symptoms may persist if non-Apple RAM passes. Remove both DIMMs and replace them with known-good Apple RAM before proceeding further with troubleshooting.



```
Memory testing failed. Non-Apple memory detected.

Number Of DIMMs: 2

Number Of Empty Memory Slots: 0

   Location           Type      Speed (MHz)      Size (MB)    Vendor
   ---------------    --------  ---------------  -----------  ----------
🟨 DIMM 0/BANK 0      DDR2      667              256          0xAD00000000000000
🟥 DIMM 1/BANK 1      DDR2      667              256          0xAD00000000000000
```

Apple RAM passes, but non-Apple RAM does not pass.

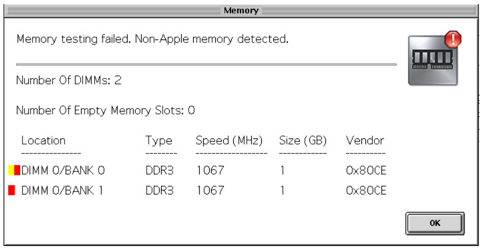
Remove non-Apple RAM and replace it with known-good Apple RAM before troubleshooting further. Non-Apple RAM is not covered under Apple warranty and cannot be sent back to Apple.



```
Memory testing failed. Non-Apple memory detected.

Number Of DIMMs: 2

Number Of Empty Memory Slots: 0

    Location           Type      Speed (MHz)      Size (GB)    Vendor
    ---------------    --------  ---------------  -----------  ----------
🟨🟥DIMM 0/BANK 0      DDR3      1067             1            0x80CE
    DIMM 0/BANK 1      DDR3      1067             1            0x80CE
```

Both Apple and non-Apple RAM do not pass.

Remove both DIMMs and replace with known-good Apple RAM before troubleshooting further. Non-Apple RAM is not covered under Apple warranty and cannot be sent back to Apple.



```
Memory testing failed. Non-Apple memory detected.

Number Of DIMMs: 2

Number Of Empty Memory Slots: 0

    Location           Type      Speed (MHz)      Size (GB)    Vendor
    ---------------    --------  ---------------  -----------  ----------
🟨🟥DIMM 0/BANK 0      DDR3      1067             1            0x80CE
🟥  DIMM 0/BANK 1      DDR3      1067             1            0x80CE
```

Troubleshooting Tips

Check connections, re-seat memory modules, and retest. Verify that memory is installed correctly. Verify that memory installed is supported for this configuration. Replace memory and retest.

MRI Log Examples - Memory

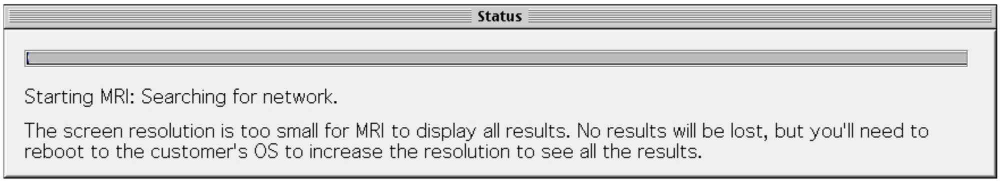
```
RESULT Memory 0 ITN4 Passed 0 Indy Knaizuk Hartmann Test

RESULT Memory 0 ITN11 Passed 0 Indy Bit Checkboard 32 Test

RESULT Memory 0 ITN68 Passed 0 Indy Check Hardware Errors Test

RESULT Memory 1 DIMM0/BANK 0 ITN50 Passed 0 Indy SMBIOS self-test check

RESULT Memory 2 DIMM0/BANK 1 ITN50 Passed 0 Indy SMBIOS self-test check

DATA Memory MLB NumberOfDIMMs 2

DATA Memory 0 DIMM0/BANK 0 Type DDR3

DATA Memory 0 DIMM0/BANK 0 Speed 1067MHz

DATA Memory 0 DIMM0/BANK 0 Size 2

DATA Memory 0 DIMM0/BANK 0 Vendor 0x80CE

DATA Memory 0 DIMM0/BANK 0 Serial Number 0x84AB5E87

DATA Memory 1 DIMM0/BANK 1 Type DDR3

DATA Memory 1 DIMM0/BANK 1 Speed 1067MHz

DATA Memory 1 DIMM0/BANK 1 Size 2

DATA Memory 1 DIMM0/BANK 1 Vendor 0x80CE

DATA Memory 1 DIMM0/BANK 1 Serial Number 0x84AB5F0F

RESULT Memory MLB FTN1 Passed 01 Aggregate Memory Test
```

Limitations

The instructions in this document address the current version of MRI only. Statements such as "will not" or "does not" do not imply that a future version of MRI would or could not change. Below are the current limitations of this system:

- AST is not intended to fully diagnose a UUT and find all problems. Technicians are expected to use AST in conjunction with ASD and other diagnostic tools for more comprehensive checking.
- AST is not intended to 'stress test' a CPU for thermal testing, etc. Technicians are expected to continue to use other tools for this purpose.
- AST relies on the UUT Mac's internal power supply to be functional in order to start up at all. If the UUT's issue is 'no power,' the tech does not need AST to troubleshoot 'no power' issues. In this case tech should follow normal 'no power' troubleshooting from the product's Apple Technician Guide troubleshooting section.
- AST relies on the presence of a working USB keyboard and mouse or trackpad to input text and navigate AST. If run on a portable where the top case trackpad and/or keyboard may be failing, connect an external USB keyboard and mouse to enter text and navigate AST.
- AST relies on a functional built-in Ethernet port to NetBoot from a DG. If you suspect that the UUT has a malfunctioning Ethernet port, consult the troubleshooting steps for Ethernet port issues in the product's Apple Technician Guide troubleshooting section.
- MRI is not intended as a "manufacturing" configuration checker—meaning that MRI does not know what CTO options, such as RAM, the user may have configured. However, it does distinguish model-specific components such as standard SD boards, Bluetooth, and AirPort cards vs optional components. Thus, if MRI does not see Bluetooth on a computer for which Bluetooth was optional, it doesn't determine whether or not this is an issue. In such cases, MRI simply highlights the module as yellow.
- To balance diagnostic accuracy and depth with speed, MRI only runs quick RAM tests, not "extended" RAM tests which can take significant time to run. Longer tests such as hard drive read/write tests, extended RAM tests and looping diagnostics are more likely to identify remote or intermittent cases, while MRI should find the most common issues. ASD is the ideal complement to AST when additional in-depth tests are warranted.
- MRI runs checks on both the customer's hardware and software. However, MRI does not run checks for software integrity or file directory corruption. Use other tools like Disk First Aid in Disk Utility to perform such checks.
- MRI does not allow looping (helpful for finding intermittent problems), due to triage and quick testing time requirements. Use ASD if looping is required.

The smallest acceptable screen resolution when running MRI is 1024x768. Since EFI cannot switch screen resolutions on the fly (and it is time consuming to do so), MRI does function under smaller resolutions, but cannot display the results. It notes this issue in the status window, as shown here:



Starting MRI: Searching for network.

The screen resolution is too small for MRI to display all results. No results will be lost, but you'll need to reboot to the customer's OS to increase the resolution to see all the results.

- For optical and hard drives, MRI does not always know the "location" of the device, so it may display something like "SATA(1,0)." This is called the "electrical" location. At this time, due to limitations within EFI and the diagnostic engine itself, there is no known way to map the drive to a more easily understandable location name.
- Due to limitations within EFI and the diagnostic engine, MRI cannot detect port hardware such as USB (port), FireWire (port), or ExpressCard. MRI can detect devices connected to that hardware (such as a USB mouse), but not the hardware to which the device is connected (the USB port itself).
- Other MRI testing limitations due to EFI restrictions:
    - MRI cannot detect the presence of a subwoofer or speakers.
    - MRI cannot detect the presence of an audio board.
    - MRI cannot detect the presence of an ExpressCard.
    - MRI cannot detect the presence of Apple display adapters.
    - MRI cannot detect the presence of antennas connected to the AirPort and Bluetooth modules.
    - MRI cannot detect individual Mac Pro hard drives connected to a RAID card. See Hard Drive MRI check description for more information.

For more information about the Notebook Adapter Diagnostic, please see http://support.apple.com/kb/CP165.